Governor's Office of

Economic Development

Centers of Excellence

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Governor

20th ANNIVERSARY REPORT
(1986-2006)

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Executive Summary

The Centers of Excellence program has a 20 year history of helping mature technologies developed at Utah's colleges and universities and bringing those technologies into the marketplace. The purpose of the Centers of Excellence Program (COEP) is to accelerate the commercialization of promising technologies that have value for Utah.

This report will explain the program's objectives and operations, detail the technology and commercialization progress of each Center and evaluate the economic impact the program has generated for the State of Utah.

Since its inception in 1986, the program has helped create thousands of high-tech jobs, assisted in the creation of spin-off companies, and by improving technologies and processes has helped hundreds of Utah companies experience tremendous growth.

Over the first 20 years of the program, the Centers of Excellence Program has generated more than 186 patents, resulting in 226 license agreements[1], and 126 plus Utah based companies have been created to license and market proprietary technology fostered by the program. 55 of these spinouts are still "alive" in Utah, three are alive out of State, and another 11 have been acquired and moved out of state. As of this report, the Utah companies directly employ over 2035 persons in the state, at an average salary over $65,000.

Well-known firms that have been assisted by the Centers of Excellence program include Myriad Genetics, Inc. (MYGN), Sonic Innovations, Inc. (SNCI), Moxtek, Cimetrix, and Autonomous Solutions Inc. Emerging successes include InfoWest, Live Wire, Andigen and Rocky Mountain Composites and startups just emerging from the Centers program in the past two years include Flying Sensors, Procerus Technologies, Wasatch Microfluidics Inc., and Glycosan Biosystems. These firms are among the many companies strengthening Utah's economy through technologies developed at Utah's colleges and universities.

These firms and many more, continue to generate new jobs in Utah and strengthen Utah's high tech business community and are strong examples of the compelling research being created in Utah's colleges and universities.

This report summarizes nearly a year of primary research to identify the results of the past two decades of the program. Extensive work was done by two interns beginning in May 2006 through February 2007. Vincent Beerman began the study and gathered the bulk of the data and performed the initial analysis, and Danica Nelson provided additional research and analysis. Vincent and Danica contacted 81 of the program's 111 principal investigators to gather data about the fruits of each of their Centers and what had happened. They then reached out to the actual companies to quantify these results. This report is the first time such a comprehensive look had been taken at the program and reveals both a tremendous "startup rate" for the Utah Centers of Excellence program, and opportunities to further improve the success rate of "significant growth" among the spinouts from the program.

[1] Patents and license agreements were compiled from historical annual reports. These reports changed formats multiple times throughout the history of the program, thus this data is only as accurate as these reports allow.

The Centers of Excellence Program Definitions

Utah State Law

Chapter 63-38f-703 - Definitions
"Centers of Excellence" means university-based, industry-supported, cooperative research and development programs.

Chapter 63-38f-901 - Purpose statement
The Legislature finds and declares that the fostering and development of industry in Utah is a state public purpose necessary to assure the welfare of its citizens, the growth of its economy, and adequate employment for its citizens.

The purpose of the Centers of Excellence Program (COEP)

To accelerate the commercialization of promising technologies that have strategic value for Utah. The COEP, which is part of the Business Creation Team in the Governor's Office of Economic Development (GOED), accelerates this commercialization process in three critical ways:

1. By selecting the most promising technology maturation proposals from those submitted by University-based research teams
2. By providing the grants to the teams to help mature the technology so that it will be attractive to potential investors and customers
3. By finding highly qualified Business Team members to help develop the plans and begin implementation of the plans to take the product to market

Additional definitions:

Benefiting Company

- Any company other than a spin-out that is using the technology from a Center in a substantial way, frequently an existing company that is a licensee of the technology.

Business Team

- Seasoned, proven technology executives and entrepreneurs recruited by the COEP to help develop strong business plans and go-to-market strategies for each Center. Although recruited on a part time "consulting" basis, these are individuals who are truly part of the Center team and are widely considered the "secret sauce" to the success of the Centers of Excellence program.

Center of Excellence

- Located at a Utah institution of higher learning, a "Center" is a designated university-based team which has previously developed specific, commercially attractive technology under Federal or corporate sponsored research grants, and which needs assistance in moving the technology forward to a "product" or "near-product" stage.

Companion Spin-out or Licensee Grants

- A company (spin-out, startup, or licensee) that forms out of a Center (i.e. is a Spinout) and receives direct assistance to the company from the Centers of Excellence program. Such a company also licenses the Center-developed technology and may also be referred to as a "Licensee."

Companion Spin-out Grants

- Funds awarded to a Center spin-out which has demonstrated that funds granted directly to the spinout would substantially accelerate job creation and economic development in Utah. These direct grants are awarded on a competitive basis and require matching funds (typically 1:1) from investors, revenue or founders.

Distinguished Center of Excellence

- A Center receiving funding in excess of $10 million or national recognition. These centers are allowed special funding beyond graduation if proposed projects are deemed worthy by the Advisory Council, Note that this was used earlier in the program's history but is rarely used at this time.

Faculty, Graduate Student and Post Doctorates Employed

- Positions being funded directly to support the Center's activity within the university setting

Graduated Center of Excellence

- The Centers of Excellence program helps specific technologies developed at a university move into the marketplace. As such, a maximum funding term of 5 years was provided from 1986-2005. Starting with the 2005-06 fiscal year, this was changed to a maximum of 4 years. The change was intended to help accelerate the time-to-market of these promising technologies and has had the practical effect of condensing the same total funding into a shorter period of time.

Industry Jobs Created

- Those jobs that have directly or indirectly resulted from activity at a Center.

Principal Investigator (PI)

- Also referred to as a Center Director, a PI is the principal researcher at a Center.

Spin-out Company

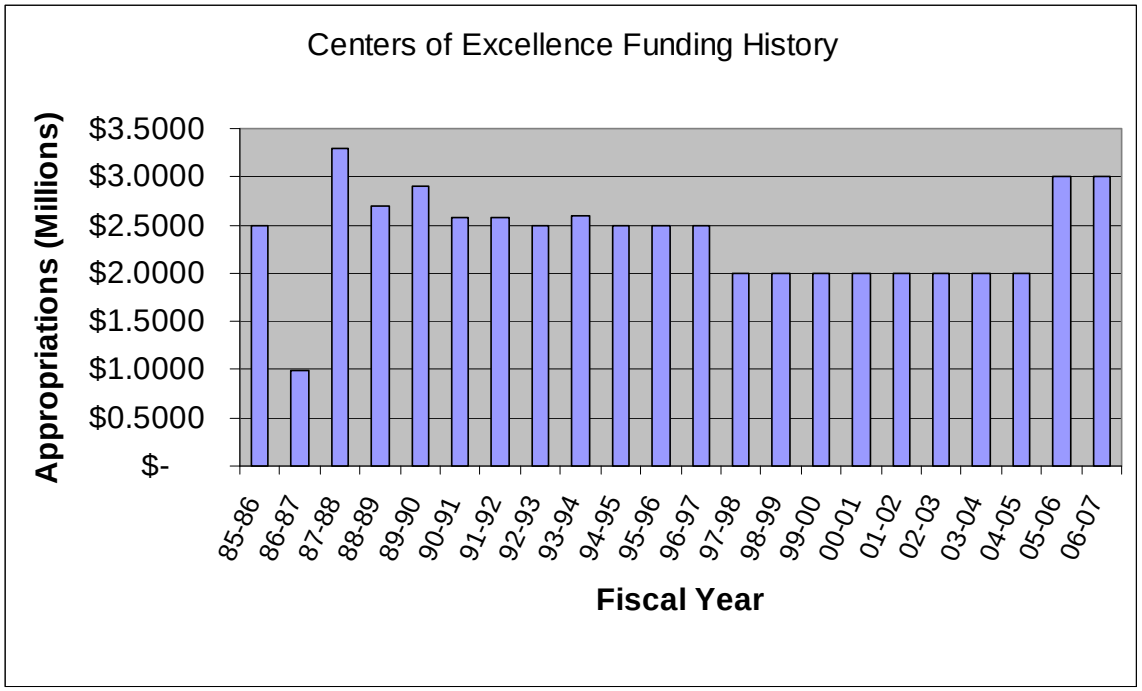
- Any startup company that is created directly as a result of Center technology.

Background

Recognizing that the growth of new industry and the expansion of existing industry in the next century would require both a strong technology base and a steady supply of new ideas, concepts, innovations, and prototypes, the Utah State Legislature created the Centers of Excellence Program (COEP) in 1986. The Legislature has recommended the allocation of economic development funds annually to the COEP, generally to be awarded to college and university faculty on a competitive basis. The objectives of the COEP are to support maturation of technologies that have potential for economic development in the state and assist in the commercialization of those technologies.

This technology commercialization process results in job creation through the formation of new companies and the enhancement of business opportunities for existing companies. In addition, the value of technologies created is further reflected in the number of patents issued and the associated royalty-bearing licenses that are signed. The State does not assume any equity positions in the licenses. Instead, the return on investment to Utah comes from converting university developed technologies into job creating products and services through spin-out or existing businesses.

Ongoing funding of the program has varied during the years. The program started in 1986 with $2.5 million in funding and maintained approximately that level until 1996-97.
Following the 1996-97 fiscal year, the program's funding remained at $2 million per year, and returned to $3 million in 2005-06. Despite the program's success, COEP funding has not kept pace with inflation. The following chart shows the history of funding for the Centers of Excellence program, through the 2006-07 fiscal year.



Operations and Objectives

The goal of the Centers of Excellence program is to help grow the economy of Utah. When the current Director joined the program, she coined the tagline, "Our job is jobs" and she has shared this perspective with everyone involved with the program. In order to help foster job growth, the COE program encourages licensing of Centers-supported technology to either existing Utah businesses, to help them develop innovative new products and services, or the startup of a new company (called a spin-out). The program continues to mentor some Graduated Centers, introducing them to sources of funding and identifying management and other talent.

Center Selection Process

In late December of each year, the COE program issues an RFP through its website which is advertised to the Universities, their Technology Commercialization Offices (TCOs), existing PIs, and other industry contacts. In response to this RFP, prospective PIs as well as existing Center Directors prepare a proposal for a potential new Center, for a business team grant to assist in preparing a future potential Center or for renewal of funding for an existing Center.

The review process is a very demanding element of the Centers of Excellence program, but also demonstrates the strong support the program has among industry and the overall Utah community. 30 or more individuals with strong technology business backgrounds, all at the Director or VP level and above, volunteer to serve on the Centers of Excellence Advisory Council as reviewers for the program. At least two reviewers, along with the COEP Director and other GOED team members review the written proposal and then conduct a site visit and review. This meeting allows the reviewers to hear directly from the PIs about the technology and business opportunity. After all proposed Centers have received a site visit and evaluation; the Director conducts what is currently a two tier selection process. In the past, the entire Advisory Council would gather in a two day process to discuss each proposal, rate them, and make the final funding recommendations. As the program has grown, that has changed into a two tier process, beginning in 2006. The Advisory Council is divided into three groups, the Life Sciences sub-committee, the Materials/Manufacturing/Energy/Environment sub-committee and the Information Technology/Aerospace/Electronics sub-committee. Each sub-committee meets and does a preliminary ranking of the proposals in their sub-committee, and makes a preliminary funding recommendation. Then, the entire Advisory Council meets together, reviews the recommendations in rank order, and makes the final funding recommendations.

The State Advisory Council (SAC) for Science and Technology has statutory responsibility for advising the Centers of Excellence Program. SAC members participate on the Centers Advisory Council, reviewing proposals and conducting site visits. This provides SAC members with in-depth knowledge of the program, Center specific information, and a strong technical and industrial perspective for making funding recommendations. The SAC also reviews the Centers of Excellence Annual Report before its delivery to the Legislature and publication.

In addition, members of the Governor's Office of Economic Development (GOED) Board also participate in the COE review process. These members are also able to verify that the selection process has been fair and was conducted in a way to help advance economic development in the state of Utah. Once the final list of recommended funding allocations is prepared, the proposed Centers and their budgets are presented to the GOED Board.

Centers of Excellence Program 1986-2006

Report Purpose

Acknowledging two decades of tremendous effort within the state in the Centers of Excellence program, the current Director decided in 2006 to perform primary research into the success of the program to date. Although some sampling data had been captured in past years, it was not a census of the program's past Centers, and it seemed that it would be helpful to reach out to every past and current Center to understand the success of each Center in commercializing its technologies.

Program Directors

The program has had the benefit of six dedicated, and quite long serving, Directors over its 20 year history. This is the first time that the list of all directors and their tenures has been compiled. Almost all of them continue to be active in the commercialization of university-developed technology, either through their industry work, through tenure at the technology commercialization offices of various Utah universities, or through continued service as reviewers for the program.

Tenure	**Director**
1986-1988	Lynn H. Blake, Ph.D.
1988-1993	G. Michael Alder
1994-2000	Roderick J. Linton
2000-2002	Rajiv K. Kulkarni, Ph.D.
2002-Jan 2005	Michael A. Keene, Ph.D., MBA
May 2005-Current	Nicole Toomey Davis, MBA

Centers of Excellence Primary Research and Analysis

Methodology

Research conducted in the summer of 2006 by Vincent Beerman surveyed 75 Center Directors of the 111 Centers of Excellence over the past 20 years. There were 24 Center Directors whose contact information could not be found or who had passed away and 12 who were unavailable during the survey period. Additional research was conducted by Danica Nelson during the end of 2006 and beginning of 2007, and seven of those 12 were surveyed and their updated center information was added to this report. The final date of data collection for this report was February 15, 2006. Former and current Center Directors were asked to update Center accomplishments and provide all available information about benefiting and spin-out companies. A thorough web search was conducted on all listed spin-out and, where possible, benefiting companies. Spin-outs were contacted and asked to verify their association with the center and provide revenue and employee information. Many companies asked us to keep this information confidential or declined our request. Confidential information was used in aggregate data but omitted from the web site and report, or was replaced with publicly available estimates, where available.

Challenges:
It is extraordinarily difficult to accurately measure the effect of a program such as the Centers of Excellence. COEP plants the seeds of business by fostering the development and commercialization of technologies at Utah's universities. Once a technology has been patented and the applications proven, the economic story often diverges and becomes difficult to trace. Some technologies are licensed to several companies, who then integrate them into existing products or build new divisions around them. Frequently, these licenses result in significant job creation in Utah, but it is nearly impossible to measure the number of jobs directly attributable to the Center as the technology is combined with existing company resources and products. Thus, the economic impact of the Center technology and COEP becomes inextricable from the overall success of the licensee.

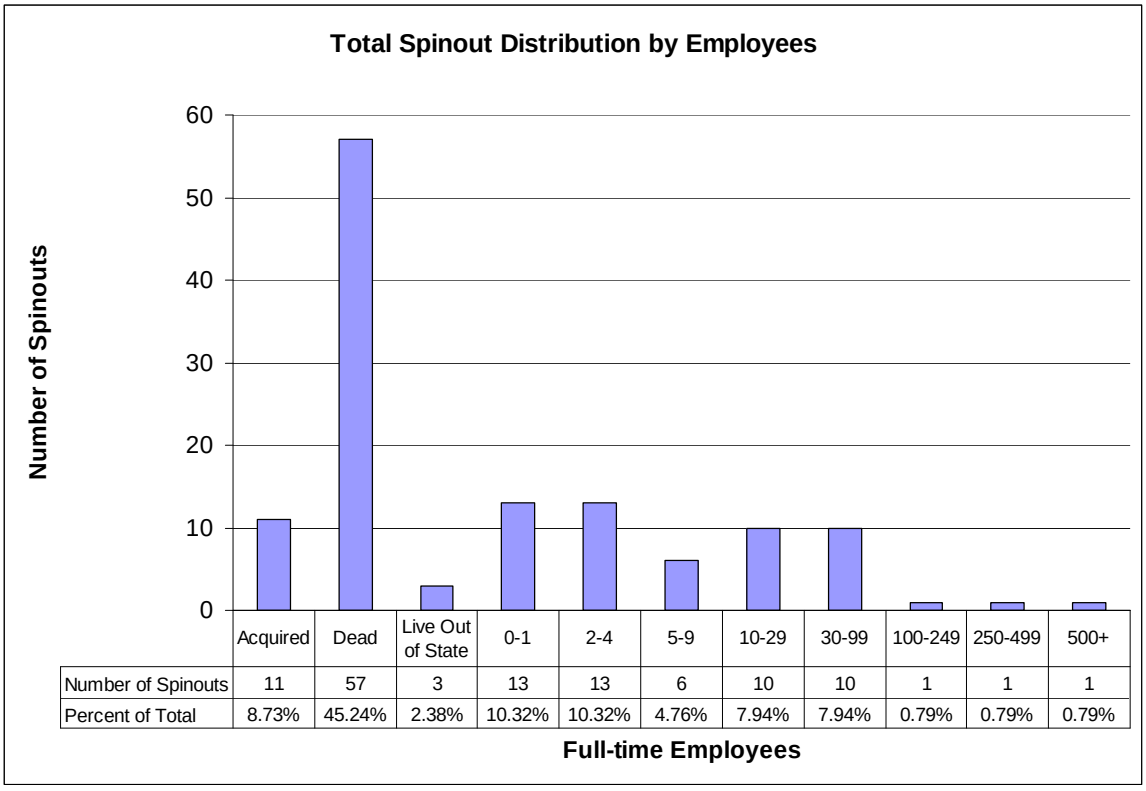
Spin-outs:
Center spin-out companies are easier to measure as they credit their foundation to a Center's personnel and technology. Although over the life of the business there are many inputs (capital, talent, other technologies and assets) that build the business, without the Centers of Excellence Program, that company would likely never have existed. Therefore we can say that COEP 'helped to create' those companies and jobs. However, many Center spin-outs have been acquired over the years. When this happens, the company facility and personnel may remain intact as a subsidiary or division, are released as redundant resources, or are absorbed into the new parent company. For the purposes of this report, if a company was left intact, those employees were still counted in the aggregate statistics. Otherwise, that company is no longer considered a "live spin-out" for the purposes of this report.

Limitations of this report:
As explained, measuring the ***total economic impact*** of the Centers of Excellence Program is difficult and imprecise. Many, if not most, of the jobs created through COEP are now inextricably tied to licensees and acquired spin-out companies across the state and the country. In spite of this difficulty, those spin-outs that we are able to track show that the program has created significant economic growth and job creation in Utah.

Corrected data:
An unpublished internal report in 2003 included some spinouts that were determined during the research of this report to be benefiting companies instead. A correction was made to the 2003 data which resulted in an adjustment of 937 jobs attributed to COEP spinouts being deducted from the initial reported total of 2,008. The corrected total number of jobs created as of 2003 is 1,966. The net increase in jobs from 2003 to 2006 is 922. The corrected ROI for 2003 is 2.04 based on an average salary of $59,000.

Spinout Distribution by Number of Employees

Of the 126 total spinouts in the history of the COEP, 11 have been acquired by companies outside the state of Utah and moved out of state, while three are still live, but were started outside of the state. For the spinouts within the state, 32 have fewer than 10 full-time employees and many of these companies have remained at that level of employment for a significant amount of time and are not likely to grow. There are 20 spinouts with 20-99 employees. Companies that employ more than 100 people bring significant benefit to the state's economy and are likely to stay within the state. These companies are often referred to as "big wins" within the Centers of Excellence community. It is important to note that companies of fewer than 500 employees are still considered small businesses by the Federal Government (for example, in the Small Business Innovation Research (SBIR) Program), but for Utah they contribute significant employment and are therefore very valuable to the state. The COEP has helped foster three such highly-valued companies: Myriad Genetics, Sonic Innovations, and MOXTEK. The following graphs illustrate the distribution of spinouts based on the number of full-time employees, thus demonstrating the history of the program and the benefits it has brought to the state.

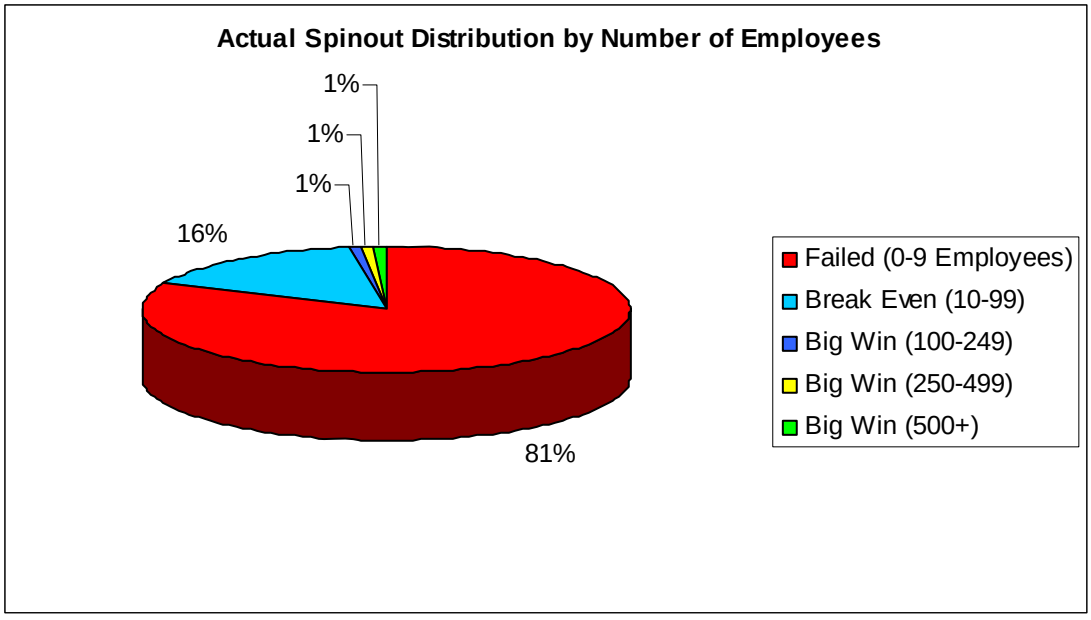


	Acquired	Dead	Live Out of State	0-1	2-4	5-9	10-29	30-99	100-249	250-499	500+
Number of Spinouts	11	57	3	13	13	6	10	10	1	1	1
Percent of Total	8.73%	45.24%	2.38%	10.32%	10.32%	4.76%	7.94%	7.94%	0.79%	0.79%	0.79%

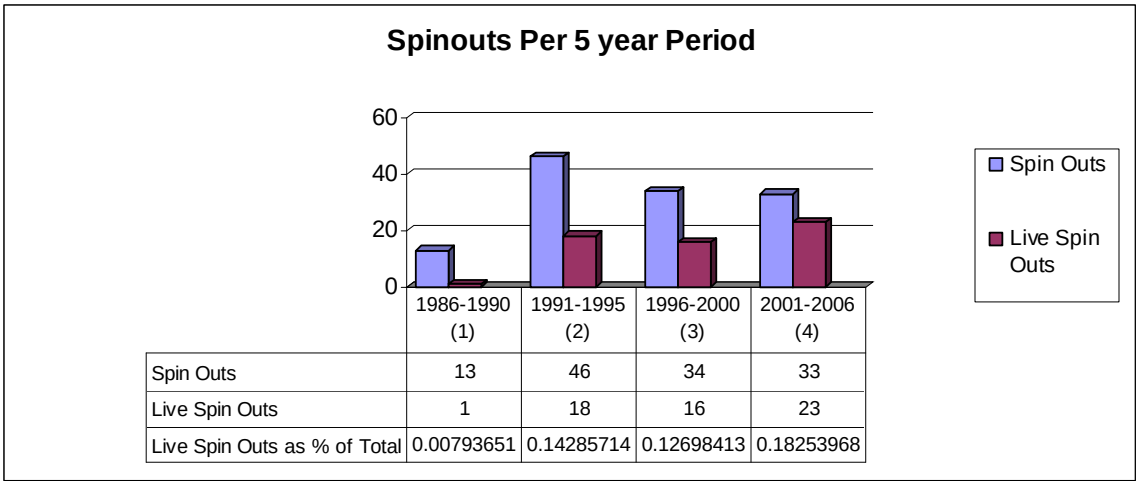
This graph shows the significant number of startups the program has helped to foster. It also points to opportunities to further strengthen the program's ability to position companies for growth to greater than 100 employees. Obviously having spinouts from the Centers of Excellence program grow to greater than 100 employees, the so-called "big wins", is highly desirable. As the graph shows, three of the 126 attempts have achieved this employment level.

As a comparison, the professional venture capital community has an expectation that 10% of their investments will reach the 'big win' category, while 30-40% are considered "losses" and the remaining 50-60% are "break even" in terms of their return to the firm. Of course the venture community's definition of "big win" is much bigger than the COE target, but the "ratio" of various levels of success is relevant.. As part of this analysis, the Director considered that any company that has less than 10 employees will likely never be able to return back to the state the investment that was made, on average over $400,000 per Center. Therefore, all Center spinouts that have failed, been acquired and moved out of state, or started out of state, are considered to have zero employees in the state and are grouped with those spinouts that are live and have 0-9 employees in the category labeled "failed." We acknowledge that in some cases those live spinouts with less than 10 employees may eventually leave that category, but as a rule, if they have never gained momentum, this is very difficult.

The graph below shows the distribution of spinouts by number of employees.

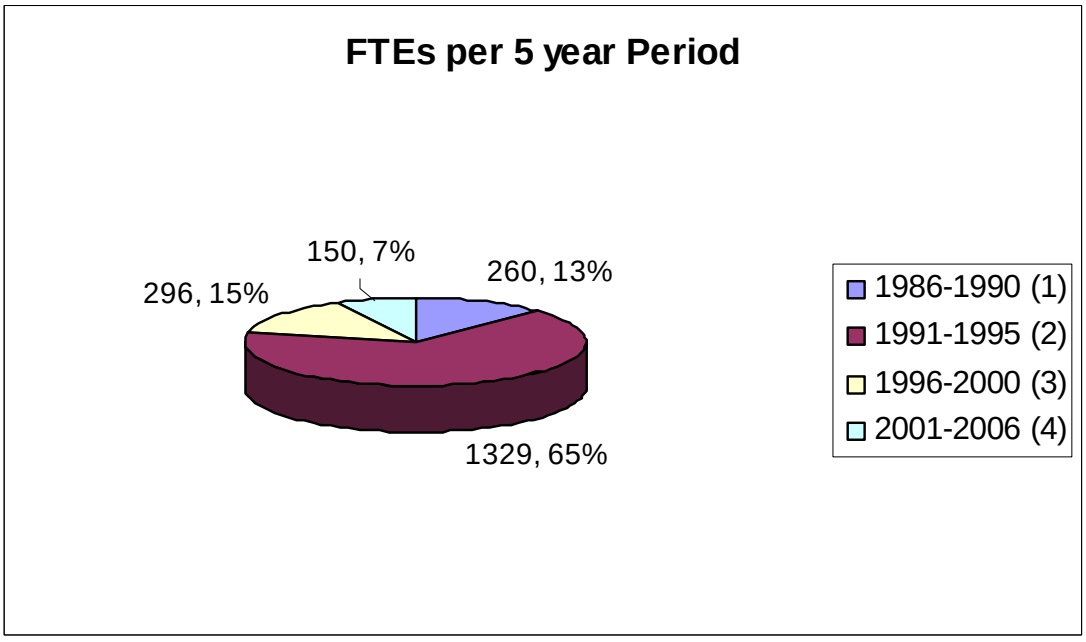


Another interesting way to look at the data is to look at the relative performance among different five-year periods. It is interesting to note that the last 10 years of the program, the number of spinouts has been fairly consistent, and that the number of live spinouts over the past 15 years of the program has also been quite consistent, with the last five years having a higher "live" rate simply due to the fact that some are still in the startup stage and their long term fate is not yet known.



	1986-1990 (1)	1991-1995 (2)	1996-2000 (3)	2001-2006 (4)
Spin Outs	13	46	34	33
Live Spin Outs	1	18	16	23
Live Spin Outs as % of Total	0.00793651	0.14285714	0.12698413	0.18253968

Even more interesting is the distribution of FTE's among the five-year periods. Clearly the period of 1991 to 1995 was the most productive as fully 65% of the people employed at spinouts of the Centers of Excellence program are employed at companies that emerged from this period. It is, of course, important to note that the period from 1996-2000 was a difficult period for startups altogether, both nationally and in Utah, due to the "dot com collapse" and retrenchment in the financial markets that followed the "boom". At the same time, some significant winners in Utah's broader technology landscape did begin in this time frame, so we know that the "external" factors alone cannot account for the very low rate of employment from this period. Of course the period of 2001-2006 has many younger companies and these are expected to have fewer employees this early in their development.



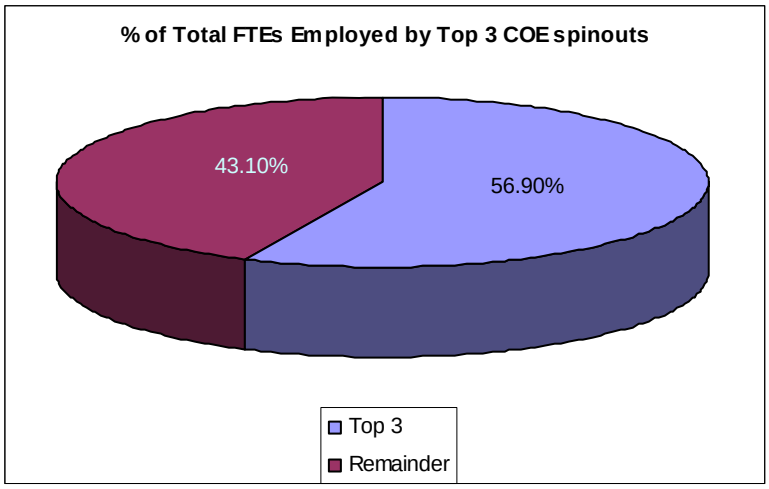
One of the challenges facing this program, a program with job creation and economic development as its primary mission, is the concentration of jobs among the largest of the

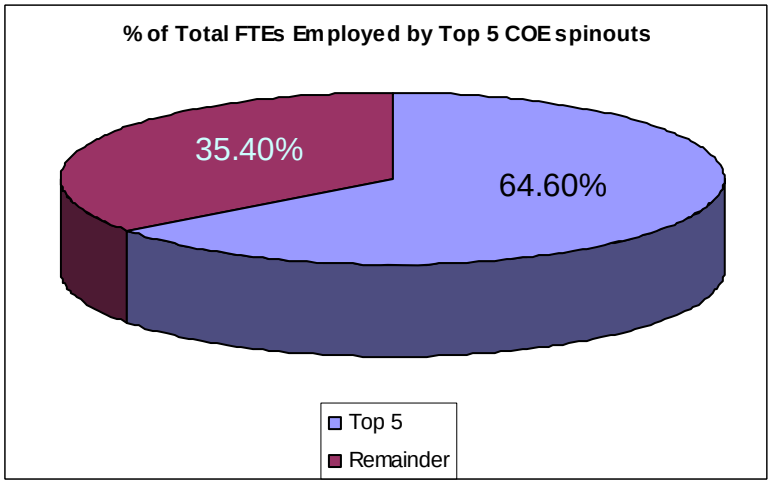
spinouts. Despite the fact that 55 of the 126 spinouts are still 'live' in Utah, the top 10 spinouts by size account for nearly 75% of all employment in the program. This indicates that we could have dramatically larger employment numbers if only some of the smaller firms (10-99 employees) had been able to grow to be larger than 100 employees.

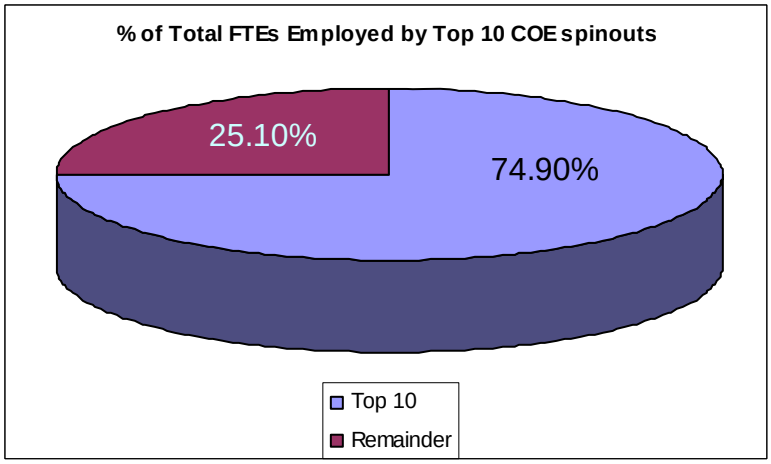
However, this points to a significant opportunity for the program that the current administration is working to capture. If spinouts can be better positioned with capital so that they can gain momentum in their earliest days, combined with increased availability of professional venture capital through the Utah Fund of Funds program, they can capture crucial early market share and presence and emerge as market leaders nationally and globally. It is this type of market positioning that helps companies grow to dominate their markets. Therefore, during the past 2 years of this administration's tenure, we have put in place significant changes that help accelerate business planning and execution for our Centers, as well as a new (in 2007) program to provide grants directly to the licensees of Center supported technologies, thus better positioning them for long term success.

Below are three charts that show the concentration of employees among the top three, top five and top 10 spinouts by size.

Charts showing concentration of employees by spinout size







Below is a list of all of the spinouts identified in this research program, listed by size. Obviously companies change size constantly, but this is a very good look at the relative spinouts that have emerged from the Centers of Excellence program. Size data comes from the primary research conducted for this report, unless otherwise noted.

COE Spinouts By Size (Active spin-outs only)

UNIV	CENTER	COMPANY	STATUS	FTE's
U/U	Cancer Genetic Epidemiology	Myriad Genetics	Live	760
BYU	Signal Processing	Sonic Innovations*	Live	100-249
BYU	X-RAY Imaging	MOXTEK	Live	138
BYU	Advanced Composites	Rocky Mtn. Composites	Live	85
USU	Self Organizing Intelligent Systems	Autonomous Solutions Inc. (ASI)	Live	72
U/U	Engineering Design	Sarcos Medical Corporation*	Live	50-99
USU	Computer Aided Engineering Design	CIMETRIX	Live	45
USU	Computer Aided Engineering Design	PROMODEL Co.	Live	45
USU	Self Organizing Intelligent Systems	Visionary Products	Live	44
U/U	Computer Graphics & Scientific Visualization	Engineering & Geometry Systems	Live	35
U/U	Design Systems	Part.Net (Medibuy)	Live	35
U/U	Controlled Chemical Delivery	Insutech became MacroMed	Live	30
U/U	Electronic Medical Education	Amirsys	Live	30
DIXIE	3D Computer Graphics	InfoWest*	Live	20-49
U/U	Cell Signaling	Echelon Research Laboratories Inc.	Live	25
U/U	Artificial Hearts and Biomedical Devices	Utah Artificial Heart Institute	Live	22
U/U	Neural Interfaces	Bionic Technologies Inc.	Live	22
BYU	Solid Oxide Fuel Cells	Materials and Systems Research, Inc. (MSRI)	Live	20
BYU	Chemical Separations	IBC Advanced Technologies*	Live	10-19
BYU	ACERC	Reaction Engineering Intl	Live	19
BYU	ACERC	Combustion Resources	Live	15
U/U	Inverse Imaging & Tomography	TechniScan	Live	15
U/U	Raman Scattering	Process Instruments	Live	15
U/U	Genome Technologies	Cimmeron Software	Live	8
U/U	Smart Sensors	Live Wire	Live	6
U/U	Direct Machining and Control	Direct Controls	Live	5
USU	Profitable Uses of Agricultural Byproducts	Andigen	Live	5
U/U	Scientific Computing & Imaging	Visual Influence Inc.	Live	5
U/U	Biomedical Microfluidics	Wasatch Microfluidics	Live	4
U/U	CROMDI	Applied Medical Visualization, Inc.	Live	4
U/U	Design of Molecular Function	MicroBioSystems	Live	4
U/U	Design Systems	ErgoWeb	Live	4
U/U	Electronic Medical Education	Visual Share	Live	4
BYU	Miniature Unmanned Air Vehicles	Procerus Technologies	Live	4
BYU	Advanced Structural Composites	IsoTruss	Live	2
U/U	Industrial Imaging	GeoChem Metrix, Inc.	Live	2
U/U	Minerals Technology	Milltech Engineering	Live	2
U/U	Minerals Technology	Mineral Technologies Inc.	Live	2
BYU	Miniature Unmanned Air Vehicles	Flying Sensors	Live	2
U/U	Smart Sensors	RF Innovations	Live	2

UNIV	CENTER	COMPANY	STATUS	FTE's
U/U	Therapeutic Biomaterials	Glycosan Bio	Live	2
U/U	Alternate Strategies for Parasite Removal	Larada Sciences	Live	1
USU	Biotechnology	Intech One-Eighty Corp.	Live	1
U/U	Biomolecular Technologies	GenMetrix, LLC	Live	0
U/U	Computational Design and Testing	Visco	Live	0
USU	High Speed Information Processing	SP Communications	Live	0
USU	Information Technology (Handicapped)	Effective Instructional Technologies	Live	0
U/U	MicroArray Technology	Sigma Technology Holding Company- now Philotek	Live	0
U/U	Nuclear, Medical, and Environmental Technology	Nuclear Labyrinth	Live	0
U/U	Quality and Integrity Design	FASIDE Itnl, Inc.	Live	0
U/U	Quality and Integrity Design	Holsip	Live	0
U/U	Therapeutic Biomaterials	Sentrx Animal Care	Live	0
U/U	Coal Research	FemtoScan Corp.	Live	0
USU	Rapid Microbe Detection	Finite Technologies	Live	0
BYU	Solid Oxide Fuel Cells	Versa Power Systems (VPS)	Live Out of State	40
USU	Self Organizing Intelligent Systems	Kachemak Research and Development	Live Out of State	0
U/U	Therapeutic Biomaterials	Sentrx Surgical - now Carbylan Biosurgery	Live Out of State	0
BYU	Computer Based Education	Cali, Inc. (became Ellis, then acquired by Pearson)	Acquired	45
U/U	Artificial Hearts and Biomedical Devices	Medquest Products	Acquired	30
WSU	Bioremediation	Applied Biosciences Corp.	Acquired	9
U/U	Cell Signaling	Salus Therapeutics	Acquired	6
BYU	Advanced Joining of Materials	Megastir	Acquired	5
U/U	Modified Activated Carbons Technology	INOTECH*	Live	n/a

**Employment Information Source: Division of Workforce Services, Firm Find*

Economic Impact Highlights

- 111 Centers
- Cumulative State funding through June 2007: **$52 million**
- Estimated matching funds: **$272 million**
- Over **126 spin-out companies** - 55 are alive in Utah today
- Spin-out companies impact
    - Employ over 2035 individuals in Utah
    - Average annual salary over $65,000
    - One year wage impact over $132 million
    - Estimated Annual personal income tax generated @ 5% rate = $6.6 million
    - COEP avg. funding last 5 fiscal years = $2.37 M/year
- Annual ROI = State tax revenue / avg. annual funding
- Annual Return on Investment = $6.6M / $2.37 M = **2.81**

Matching Funds

Under the statute changes passed during the 2006 Legislative session, Centers at a university that awards doctoral degrees ("the doctoral granting institutions") are required to have 2:1 matching funds. This is because these institutions have significant Federal research programs which bring with them momentum and many helps in identifying and securing funding. At universities without these robust, doctoral granting programs, securing research funds is more challenging. Therefore, in the 2006 session, the Utah state Legislature modified the matching requirement so that Centers at non-doctoral granting schools were not required to have the 2:1 match, and in policy the program adopted a 1:1 matching requirement. All matching funds are reviewed through the Center's annual reports. A key element of the program is the emphasis during the renewal process on the achievement of milestones and commitment to commercialization.

Center of Excellence funds are credited by many researchers as "priming the pump" for additional research funds. Although COEP requires a 2:1 matching funds ratio for doctoral granting institutions, most Centers raise considerably more in outside funds from federal and private grants. Although this money is spent on a variety of equipment and activities, some of which leaves the state, much of it goes to pay local researchers' salaries and local utilities and supplies. At the time of this report, matching funds data was available for 34 centers. The ratio of matching funds to those provided by COEP was 5.24:1. Assuming this ratio is representative of all the Centers, approximately $272 million has been funneled into Utah through the Centers since 1986.

Metrics by Cluster, School and Age of Center

The success of the COEP program is demonstrated in the following metrics that are grouped by clusters, institution, and age quartile (the year in which the Center operated expressed in quarters of the COEP's 20-year history.) Performance indicators include the number of centers that were funded, the number of spinouts created, the number of companies benefiting through a license agreement, full-time employees of the spinouts, revenue generated by the spinouts, and that revenue divided by the number of centers.

Clusters	# of Centers	# Total Spinouts	# Live Spinouts	# Benefit-ting Co's	FTEs	Avg Salary	Reported Revenue ($M)	Average Jobs/ Center	Revenue/ Center
Aerospace	4	9	2	5	6	$86,667	2	1.5	$450,000
Competitive Accelerators	27	19	11	289	277	$61,000	12	10	$450,741
Defense & Homeland Security	3	6	5	1	124	$45,000	10	41	$3,333,333
Energy & Natural Resources	12	11	9	31	108	$76,830	15	9	$1,288,333
Life Sciences	34	45	19	53	1,316	$58,778	119	39	$3,485,294
Software & IT	31	36	12	39	204	$70,521	26	7	$830,645
Total	**111**	**126**	**58**	**418**	**2035**		**$183.7**		
Institution									
U of U	61	57	36	82	1180	$68,589	110.25	19	$1,807,377
USU	23	27	9	34	126	$60,000	10.26	5	$446,087
BYU	21	28	12	293	695	$62,686	59.17	33	$2,817,619
WSU	4	5	0	8	9	$50,000	1	2	$250,000
Dixie	1	5	1	1	25	$0	3	25	$3,000,000
UVSC	1	4	0	0	0	$0	0	0	$0
Total	**111**	**126**	**58**	**418**	**2035**		**$183.7**		
Age Quartile									
1986-1990 (1)	9	13	1	18	260	$0	0	29	n/a
1991-1995 (2)	29	46	18	148	1329	$63,282	139.37	46	$4,805,862
1996-2000 (3)	31	34	16	221	296	$76,923	23.4	10	$754,839
2001-2006 (4)	42	33	23	31	150	$65,449	20.91	4	$497,857
Total	**111**	**126**	**58**	**418**	**2035**		**$183.7**		

Outstanding Successes

The following descriptions provide additional insight into some of the successful and emerging spinouts that are powering job creation in the State of Utah. This list is only meant to provide a sampling of information. Appendix A provides a summary of every Center of Excellence since the inception of the program, and includes contact information and a list of spinouts.

Myriad Genetics (MYGN) - 1991

A spin-out from the Center for Cancer Genetic Epidemiology at the University of Utah, Myriad is a biopharmaceutical company that develops novel healthcare products to address some of the most pervasive diseases such as cancer and Alzheimer's. Their products include predictive cancer products in addition to drug therapeutics. The company is a leader in cancer prediction medical products, such as BRACanalysis for breast cancer and COLARIS for colon cancer. Myriad also develops and markets predictive and personalized medicine products. Currently, the company is engaged in the largest placebo-controlled study ever undertaken of an investigational medicine in patients with Alzheimer's disease.

Myriad was formed in 1991 and went public in 1995, with an initial public offering valued at $54 million. In 2005, the company earned revenues of $82 million with 760 full time employees and a median salary of $58,000. Approximately 660 of those employees reside in Utah. As of February 2007, the company was valued at $1.51 billion.

Sonic Innovations (SNCI) - 1995

A spin-out from the Center for Signal Processing at Brigham Young University, SONIC innovations has become the fastest growing hearing aid company in the world. Through the development of patented digital signal processing technology at Brigham Young University, the company produces the smallest single chip platform ever installed in a hearing aid. The success of the companies product is a direct result of the developments at BYU that give the hearing aids the ability to accurately reproduce natural sound from an extremely small device.

Sonic Innovations was founded in 1995 and went public in 2000 with an initial offering of 3,600,000 shares at $14.00 per share.. The company received total net proceeds, including the exercise of the over allotment, of $53.9 million. Sonic has grown to more than $100 million in revenue with operations in nine countries. The company was valued at $187 million in February 2007. The company employed 634 individuals in 2005, 110 of which are in Utah with an average salary of $80,000.

Moxtek - 1986

A spin-out from the Center for Xray Imaging at Brigham Young University, Moxtek is an OEM provider for X-ray analytical products and wire grid polarizers for projectors and rear-projection televisions. The company was founded on specialized optical technology developed at Brigham Young University. Their polarizer technology is a leader in the projection industry, and is used in most major-brand high definition televisions. Moxtek was awarded the 2002 Silver Award by the Society for Information Display (SID) in recognition of its ProFlux polarizer.

Moxtek was founded in 1986 by a group of professors and was acquired as a wholly owned subsidiary of Polatechno in 2004. The acquisition kept intact Moxtek headquarters in Orem, UT and retained the company name and personnel. Through the increased access to capital, Moxtek has been able to expand capacity. This has led to increases from $9.4M in sales and 60 employees in 2004 to 138 full time employees with an average salary of $36,000 and $31 million in sales in 2006.

Autonomous Solutions Inc. – 2000

A spin-out form the Center for Self Organizing Intelligent Systems at Utah State University, Autonomous Solutions, Inc. produces unmanned vehicle systems based on technology developed at Utah State University. The company has developed products for many top companies, including a robotic vehicle for Goodyear to safely test tires without human drivers. The company has received such a high interest in its products that it is actually turning down customers, according to the founder. Recently, ASI won a million-dollar grant to develop an unmanned vehicle for the Department of Defense's Grand Challenge in November 2007. The company will be competing against major corporations such as Lockheed Martin and Boeing.

ASI was founded in 2000 by Mel Torrie, who was a graduate student working in the Center at USU. The company now has over 72 full-time employees earning an average of $45,000 and 2006 revenues were over $7 million.

Cimetrix (CMXX) - 1985

A spin-out from the Center for Computer Aided Engineering Design and Manufacturing at Utah State University, Cimetrix is a public company located in Salt Lake City, UT that designs factory automation software for the global semiconductor and electronics industries. Cimetrix's PC-based motion control software is used by leading equipment manufacturers for demanding robotic applications. One of the company's most recent products, CIMPortal, has been selected for Semiconductor Equipment and Materials International's (SEMI) Interface A standards compliance by 50 percent of the top 20 largest semiconductor equipment suppliers in the world.

Cimetrix was founded in 1985 based on open architecture motion control software developed at Brigham Young University. Cimetrix used this core PC based technology to develop a unique software framework bringing to life the Cimetrix Open Development Environment (CODE). The company continues to receive worldwide recognition and increasing sales. 2006 revenues were $5.637 million with 45 full time employees worldwide, 36 of which reside in Utah. The company was valued at $9.2 million in February 2007.

Flying Sensors - 2006

One of two spin-outs from the Center for Miniature Unmanned Air Vehicles at Brigham Young University, Flying Sensors is a full-service, aerial-based, data collection company. Their unique approach combines aerial photography and video with unmanned air vehicles and aerial sensing technology developed at Brigham Young University to provide aerial detail not available by traditional means. The company integrates these technologies with their patent-pending analysis and presentation tools to give its customers a complete aerial imaging product. Their products

and services are used for many imaging applications such as real estate, environmental studies and motion pictures.

Flying Sensors was founded in 2006 by Bob Carter and Brian Odette. The company currently has 2 full time employees with an average salary of $100,000. Flying Sensors will record its first revenues in August 2006.

Procerus Technologies - 2004

The second spin-out from the Center for Miniature Unmanned Air Vehicles at Brigham Young University, Procerus designs small automatic pilots for miniature unmanned air vehicles using leading edge technology developed at Brigham young University.. This technology led to the company's premier product, the Kestrel. This is the smallest and lightest autopilot on the market and is used by military and research institutions. In addition, the company offers ground control software to be fully integrated with the autopilot.

Procerus Technologies was founded in 2004 by the Center Director and partners. In 2005, Procerus had approximately $1.8 million in revenues with 4 full time employees averaging $80,000 in salary.

InfoWest - 1994

A spin-out from the Center for 3D Computer Graphics at Dixie College, InfoWest has been a leading provider of high quality Internet services to the Utah community since 1994 and was the first to offer Internet services to Southern Utah. Being the first provider in this community led to the company's name being synonymous with the Internet. Even today, with many competitors in the area, InfoWest maintains the majority share of the market. InfoWest continues to lead by providing fiber-optic transmission and advanced spam and virus filtering.

Established in 1994, InfoWest came together under through a group of former IT students at Dixie College under the direction of Eric Pedersen. The idea was born when this group helped to equip the college campus with Internet service. InfoWest has since had a ten-year up-trend in revenue and has spun-out several other companies including NetEx.net, DevShed.com and 32Bit.com. The company currently has approximately 49 full time employees in Utah.

LiveWire Test Labs - 2003

A spin-out from the Center for Smart Sensors at the University of Utah, LiveWire Test Labs provides technologically advanced and easy to use products for identifying the nature and location of faults in live electrical wiring systems. The company was founded on technology developed at the University of Utah, called Spread Spectrum Time Domain Reflectometry (SSTDR). This technology allows testing on live wiring systems and is able to detect problems that traditional methods have failed at. SSTDR is capable of sensing faults in the wiring without interfering with normal operation, thus making it useful in a multitude of applications, such as on aircraft during flight. This is particularly beneficial for use on aging aircraft for compliance with FAA standards.

LiveWire was founded in 2003 by the Center Director, Cynthia Furse and partner Paul Smith. The company currently has 6 full time employees and is growing rapidly.

Andigen, LC - 2003
A spin out from the Center for Profitable Uses of Agricultural Byproducts at Utah State University, Andigen designs and builds high rate anaerobic digester systems for animal waste. The patented digester processes animal waste into methane gas which is pumped into an engine and converted into electricity. This allows farmers to manage pollution and odor, and gives them an additional revenue stream if they choose to sell the electricity back to the utility company. The methane gas may also be used to produce biodiesel.

Andigen is growing rapidly with worldwide sales out of its headquarters in Logan, UT. Founded in 2003 by the Center Director - Dr. Conly Hansen and partners, Andigen maintains ongoing research collaboration with Utah State University. Revenues from 2005 were $260,000 and 2006 revenues are forecasted at $1.5-$2M. In 2006 there were 5 full time employees with an average salary of $75,000.

Perspectives About the Centers of Excellence Program

SSTI
"Utah's approach is unique -- the partnership between economic development, the tech transfer office, and the commercialization transfer office, makes sense and seems to be working. …I can't point to any other program that has the same results."

--Dan Berglund, President and CEO, SSTI -State Science and Technology Institute

MedQuest/Worldheart
"I recently sold the company that I co-founded (MedQuest Products Inc.) to a publicly-traded company, WorldHeart. My company was a spin-off of the Center for Artificial Hearts at the University of Utah, which is a Distinguished Center of Excellence and has obtained COE funding/support since 1988 for both Artificial Hearts ('88-'92) and Ventricular Assist Devices (1 yr in the mid-90s). The COE support for VAD commercialization was very important at that time- we used COE-recommended commercialization consultants and also worked with the UU Tech Transfer Office to get things moving for my business. This early support has played a role in our success so far: from Mar-June 2006 we had our first successful patient experience with our revolutionary VAD. The news of this implant was carried all over the world: Russia, Australia, South Korea, India and so on… (including the US and Europe of course). I believe it demonstrated and reinforced Utah's leadership in this field that had been established in 1982 with the first implant of a long-term artificial heart in Dr. Barney Clark- a heart that was developed by Symbion (at that time a UU spin-off) and the Center for Artificial Hearts."

-- Pratap Khanwilkar, PhD, MBA, VP: Rotary Systems & Business Development Worldheart, Inc.

Center for Thermal Management Technologies
"It is my observation that most university faculty in engineering and science are talented, dedicated, hard working people with more great marketable ideas than they have time to develop without substantive encouragement and support. Academics are often not business oriented

people and so many ideas with potential commercial application languish and miss the passing window of opportunity. Utah's COEP provides the needed incentive and support for busy faculty to develop their ideas into useful products. Students involved have their education enhanced by real world applications as the states economy is benefited. It seems like a win-win all around. Please count me as an enthusiastic COEP advocate."

--J. Clair Batty, Trustee Professor Emeritus, Utah State University

Flying Sensors

The Centers of Excellence (COE) program has been on of the key stepping stones to launching Flying Sensors. I was a consultant for the BYU magic lab (the Center for Miniature Unmanned Air Vehicles) that focused on small unmanned aerial vehicles. My partner, Brian Odette and I quickly realized the commercial potential for their technologies in an industrial setting. Most UAV work was focused on the military and this left a great opportunity to integrate existing technology into a new vertical market. The first grant we received from the COE program allowed us to immediately get matching funds from a private investor. The COE, private equity and revenue funded the first year growth and infrastructure development. As founders we utilized the income from our consulting efforts to buy the assets necessary to launch a successful unmanned aerial product and service company. The COE funds provided operating capital to hire the necessary personnel to get the company launched. The second year award is critical as we expand our efforts and hire additional personnel to accelerate our growth. I have been an entrepreneur of many different startups. I see COE providing the essential bridge to motivate people to take the necessary risk to spin research technologies out into industry. I am proud to be associated with this program and lead the way for other future companies.

--Bob Carter, CEO, Flying Sensors

Future Research

The depth of primary research conducted for this report provides significant insight into the program's performance. However, some crucial questions emerged from this data that will form the basis for future research to help strengthen the program and Utah's economy. These questions include: Why did so many spinouts fail outright? Are the issues related to management? Capital? Licensing issues and terms? PI focus and involvement? Are these still barriers or have any/all issues been resolved? What issues remain to be resolved?

Other questions that need additional research to answer include: Why did three of these spinouts start out of state entirely? What ingredients in Utah's economy were missing or what problems were there? Why did so many of these spinouts get "stuck" in the 0-9 employee category? What are these companies doing and how are they structured? Are the PI's still involved? Who else is employed by these companies? Why didn't more of the 10-99 employee companies keep growing to breach that 100 employee mark? How did Utah's private sector startup community fare relative to the COE startup community? What are other states doing in the very early seed stage area and how successful are their programs? How does Utah's COE Program compare against these other programs in terms of effectiveness and what might some additional "best practices" be?

And finally, looking for opportunities to replicate success leads to questions such as: What were the key elements that helped to contribute to the success of the three "big wins" that did occur? How could those same factors be brought to bear on a wider segment of Centers spinouts?

More information about the benefiting companies and the level of benefit received from their work with the Centers would be helpful. In the end, did any of them license and use Center technology to significantly grow their businesses? How? What works/doesn't work in the company/professor/university relationships?

Future research efforts will be made to answer these and other questions that emerge.

Program Evolution – Building on Success

The Centers of Excellence Program is building on the past 20 years of success. Based on successful examples of technology commercialization, the COE Director, under the new leadership of the Governor's Office of Economic Development, is working to strengthen those elements of the program that have been crucial to success as well as to introduce new opportunities.

Accelerate time to market

Funding Period Compressed to Four Years

During the first 19 years of the program, the funding time frame allowed a maximum of five years for a Center. During the 05-06 fiscal year, this time frame was compressed from five years to four years – with roughly the same amount of money allocated to each Center over the history. The purpose of this change is to accelerate commercialization and reduce the time to market.

In addition, the COE program implemented a system to provide business team assistance to "Potential Centers" before they receive full funding in order to improve their performance during their funded time as a Center. This replaces the past "planning grants" (typically around $5,000) that were made directly to a potential Center. Instead, this money is directed to the business team for assistance during the year. During the 2006 selection process this was expanded to authorize approximately $75,000 to fund pre-proposal business team assistance (enough for 5-7 Centers) before they applied to the COE program. All of this is intended to help prepare university teams for the COE program, to facilitate the selection process and to further accelerate commercialization.

The first example of a new team with this support occurred during the 05-06 year. During the 2006 selection process, one seasoned COE Reviewer said, "I had to keep reminding myself that this was a new Center, their presentation was so good!"

Business Expertise Essential to Success

Throughout most of the program's history, Utah has sponsored "COE consultants" to work with each Center. These consultants spent about 80 hours per year working with a given Center. They were paid through the universities by a block grant provided by the state and were selected by the universities from a list of consultants approved by the State.

For the 2005-06 fiscal year, the former "COE consulting program" underwent a complete overhaul to result in the COE Business Team program. Under the Business Team program, seasoned technology executives, serial entrepreneurs, and market experts were recruited through a statewide RFP to meet the specific needs of each Center. In addition, the funding level was increased to pay for approximately 250 hours of assistance per year for each Center, significantly increasing the ability of the Business Team members to help move the technologies out of the university and into industry.

This enhancement builds on the historical importance of providing business expertise to complement the technical expertise of each Center, while helping to pair entrepreneurs and seasoned executives with the Centers as part of the process of building strong startup and "go to market" teams. In addition, the Centers program has emphasized that licensing to an existing Utah company is a very positive outcome and has encouraged our business team members to search out Utah firms which might have an interest in these technologies.

Industry-University collaboration

A major objective of the Centers of Excellence program under the Huntsman Administration is to significantly increase the interaction between members of industry and university talent in order to facilitate the exchange of technologies and opportunities. Strong economies around the world are built around the movement of technologies from research institutions into industry, and the subsequent flow of funds and talent back to the institutions. It is the goal of the COE Director that the Centers of Excellence Program can help increase this virtuous cycle in Utah and further strengthen our high tech economy.

Changes in Legislation

Utah's Legislature is very sensitive to the value of technology based economic development and the current Director has taken the opportunity to approach the legislature twice to ask for changes that strengthen the COE statute and enhance the program.

2006 Legislative Changes

During the 2006 Legislative session, Senator Thomas Hatch sponsored Senate Bill 112, with House sponsor Representative Peggy Wallace. The centerpiece of this bill was changes in the COE statute which were implemented to encourage the non-doctoral schools in the State to participate in the COE program by reducing the matching requirements for those schools from 2:1 to 1:1. In addition, when a doctoral-granting school and a non-doctoral granting school partner in a so-called "supercenter", the non-doctoral granting school is not required raise any matching funds, although the doctoral granting school still maintains its 2:1 matching requirement.

Matching Requirements for schools that do not offer Doctoral degrees

During the 2006 legislative session, the Utah State Legislature passed, with no dissenting votes, SB 112, Centers of Excellence Amendments. One of amendments included in this bill narrowed the requirement of the 2:1 match to schools that offer Doctoral degrees (language listed below). This statutory change also required match guidelines for schools that do not offer doctoral degrees. The new guidelines are listed below.

Statutory Change

"The Legislature recommends that the governor consider the allocation of economic development funds for Centers of Excellence to be matched by industry and federal grants on at least a two-for-one basis for colleges and universities in the state that offer any doctoral degrees"

New Guidelines:

- For a non-doctoral-degree granting school, a stand-alone Center will be required to have its Centers of Excellence funds to be matched by industry and federal grants on at least a 1:1 basis.
- When a non-doctoral-degree granting school partners with a school that does grant doctoral degrees, the non-doctoral-degree granting school will not be required to have a match for their portion of the COE funding. The doctoral-granting school will be required to meet their 2:1 match as per statute.

Note: The COE Statute specifies that, "Proposals or consortia that combine and coordinate related research at two or more colleges and universities shall be encouraged."

Additional changes by the Legislature modified the Accountability of Licensing Decisions in Centers of Excellence. Excerpts are included below.

Accountability of Licensing Decisions in Centers of Excellence

During the 2006 legislative session, the Utah State Legislature passed, with no dissenting votes, SB 112, Centers of Excellence Amendments. The Second Statutory Change in SB 112 is detailed below.

"The Governor's Office of Economic Development shall develop a process to determine whether a college or university that receives a grant under this part must return the grant proceeds if the technology that is developed with the grant proceeds is licensed to a licensee that:

(i) does not maintain a manufacturing or service location in the state from which the licensee or a sublicensee exploits the technology; or

(ii) initially maintains a manufacturing or service location in the state from which the licensee or a sublicensee exploits the technology, but within five years after issuance of the license the licensee or sublicensee transfers the manufacturing or service location for the technology to a location out of the state."

The Governor's Office of Economic Development is currently in the process of establishing the process specified in the statute. The State Advisory Council on Science and Technology, as requested by the Office, has convened a task force to make recommendations to GOED on this process. In addition, the Governor's Office of Economic Development Board will provide final review and approval of the process.

Procedural Updates

In February of 2006, in order to continue strengthening the program, the COE Director took before the State Advisory Council of Science and Technology a series of procedural enhancements and clarifications which were approved. These are listed below.

Centers support for licensed technologies

- Past: once a technology was licensed to a company, the Center could no longer be funded or support the technology.

Opportunity:

- Permit a Center to continue to support a licensed technology for a certain period of time or under certain conditions in order to better support the transition from university to industry.

New Guideline:

- When a Center-supported technology is licensed to an existing established firm, the Center can use the COE funding to support that technology through the end of the current fiscal year (i.e. current contract).
- When a Center-supported technology is licensed to a startup/spinout, the Center can use the COE funding to support that technology through the end of the current fiscal year (i.e. current contract).
- In addition, the Center may apply for renewal of funding from the COE program (subject to the normal term of up to 4 years), to enable the Center and Business Team to continue to support the technology AND those commercial applications UNTIL a) the startup/spinout completes an arms-length financing transaction with a value equal to or greater than $500,000 or b) the startup/spinout is awarded one or more contracts with a value equal to or greater than $500,000.
- In all situations, if there are still significant applications of the technology available for licensing (other vertical markets) the Center may apply for renewal of funding from the COE program on a competitive basis.

Ability to Start the COE Funding Clock over for new Opportunities

- Past: Once a Center was "done" with one round of funding, they could not really "come back" into the program unless it was a "new Center" (with new PI)

Opportunity:

- Proposed: Dynamic Centers teams and PIs have many areas of research that can provide new Market Opportunities
- COE should encourage them to continue to bring new technologies to the program for new Market Opportunities

New Guideline:
A former Center of Excellence (one that has "graduated"), may return to the program and request a new series of funding years, typically up to 4 years, as long as the technology that is being proposed for commercialization is different enough from the original Center to create new market, business and licensing opportunities. However, it should NOT be used to extend the life of a Center that failed to achieve their commercialization goals. The Center may either keep its same name with a differentiating designation (example "Center II"), OR may propose under a new name. The PI may be the same PI or may be a different PI (but there is no requirement to make a change).

Center Designation – Funding + 3 years

- Past: Conflicting interpretations of use of "Utah Center of Excellence" Title

New Guideline:
A Center can use the "Utah Center of Excellence Designation" (and logo) for the term of funding plus 3 years. After that they can refer to being a "former Utah Center of Excellence". If, after 3 years, a Center is still actively supporting the commercialization of the technology which was funded through the Center, they may apply to the Director for an extension of the use of the title.

Clarification: The name of the Center ("Center for New Technology") is not covered by this guideline and it is up to the college/university, PI and team to determine its appropriate use.

Additional Item of Clarification from the Feb 13, 2006 Meeting of the SAC

The council concurs with the Director that PI's/Researchers do NOT have to be tenured to be considered as a Director for a Center of Excellence.

2007 Legislative Changes

During the 2007 Legislative session, Representative Bradley Daw sponsored House Bill 125, with Senate Sponsor Senator Sheldon Killpack. The goal of this statutory change was to permit the program to make funding grants directly to licensees of university technologies. It was clear from research and experience with the program that the COE funded ended frequently at precisely the moment it was most needed – when the technology rolled out of the university and into the company.

Utah's Legislature agreed that it was a wise use of state funding to help defray the real and perceived risk in licensing university technologies. The funds are specifically earmarked to help existing firms and startups fund the transition and "go to market" work of getting the technology out of the lab and into a product. These funds require a 1:1 match from the company and those funds can be founder cash contributions, investor funds, or sales or contract revenue. The 2007-08 selection process will the first time that such funds are available to licensees (companies).

Tables of Centers and Spinouts

Below are lists of the Centers and their spinouts, organized in a variety of formats to share insights about the program's history.

Centers by Cluster

The Centers are linked to their respective websites where links to the universities, spinouts, and annual reports can be found.

CLUSTER	CENTER	FUNDED	GRADUATED	SCHOOL
Aerospace	Space Engineering	1986	1991	USU
	Advanced Satellite Manufacturing	2004	2006	USU
	Miniature Unmanned Air Vehicle	2004	Currently funded	BYU
	Aerospace Science Technology	1987	1992	Weber State
Competitive Accelerators	Chemical Reactors	1989	1990	U of U
	Pyrometallurgical	1988	1989	U of U
	Advanced Materials & Microelectronics	1987	1992	U of U
	Engineering Design	1987	1992	U of U
	Quality & Integrity Design	1989	1991	U of U
	Advanced Construction Materials	1993	1997	U of U
	Composites in Construction	1998	1999	U of U
	Harsh Environmental Electronics	1995	2000	U of U
	Raman Technology	1996	1998	U of U
	Computational Design & Testing	2002	2004	U of U
	Functionally Graded and Designed Cemented Tungsten Carbide and Polycrystalline	2006	Currently funded	U of U
	Magnetic Sensor & Actuator materials	2005	2006	U of U
	Nanosize Inorganic Material Powders	2004	Currently funded	U of U
	Novel Titanium Boride Surface Hardening Technology	2003	Currently funded	U of U
	Rapid Prototyping	2001	2004	U of U
	Utah Research Institute	1987	1992	USU
	Control of Flow in Manufacturing	2006	Currently funded	USU
	Thermal Management Technologies	2006	Currently funded	USU
	Advanced Composites Manufacturing & Engineering	1989	1995	BYU
	Chemical Separation	1987	1992	BYU
	Computer Aided Engineering Design & Mfg (CA2EDM)*	1988	1992	BYU
	Application Center for Materials Engineering	1996	1997	BYU
	Rapid Product Realization	1993	1996	BYU
	Advanced Joining of Materials	1999	2004	BYU
	Advanced Structural Composites	1998	2003	BYU
	Compliant Mechanisms	1999	2004	BYU
	DMAC--Direct Machining & Control	2002	2005	BYU
	Smart Sensors	2000	2005	U of U
Defense	Self Organizing Intelligent Systems	1993	2000	USU
	Advance Imaging LADAR	2003	Currently funded	USU

	Coal & Oil / Coal Research	1987	1991	U of U
	Coal Processing Technology	1996	1998	U of U
	Minerals Technology	1995	1999	U of U
	Acoustic Cooling	2000	2004	U of U
	Modified Activated Carbons Technology	2005	Currently funded	U of U
Energy & Natural Resources	Petroleum Research	2000	2005	U of U
	Solid Oxide Fuel Cell Technology	1996	2001	U of U
	Solid Waste Recycling	1990	1993	USU
	Profitable uses of Agricultural Byproducts	2000	2005	USU
	Advanced Combustion Engineering Research	1987	1995	BYU
	Supercritical Fluid	1987	1991	BYU
	Solvent Separation of Heavy Oils	1996	1997	Weber State
	Laser Institute	1986	1989	U of U
	Artificial Hearts & Biomedical Devices	1987	1992	U of U
	Biopolymers at Interfaces	1986	1991	U of U
	Cancer Genetic Epidemiology	1990	1995	U of U
	Controlled Chemical Delivery	1986	1993	U of U
	Environmental Technologies	1993	1995	U of U
	Biomolecular Technologies	1998	2000	U of U
	Cell Signaling	1997	2002	U of U
	Genome Technologies	1996	1998	U of U
	Neural Interfaces	1995	2000	U of U
	Ventricular Assist Device	1995	1996	U of U
	Alternate Strategies Parasite Removal (CASPeR)	2004	2006	U of U
	Biomedical Microfluidics	2004	Currently funded	U of U
	Biomedical Optics	1999	2003	U of U
	Homogeneous DNA Analysis	2003	Currently funded	U of U
	In Situ Ozonator	2003	2004	U of U
Life Sciences	Microarray Technology	2005	Currently funded	U of U
	Nuclear, Medical and Environmental Technologies	2001	2003	U of U
	Therapeutic Biomaterials	2004	Currently funded	U of U
	Vascular Biotherapeutics	2001	2003	U of U
	Biotechnology	1987	1992	USU
	Design of Molecular Function - Environmental	1988	1994	USU
	Dairy Foods Technology	1990	1996	USU
	Developmental & Molecular Biology	1992	1998	USU
	Genetic Improvement In Livestock	1993	1997	USU
	Meat Processing Technology	1990	1996	USU
	Value Added Seed Technology	1990	1997	USU
	Dairy Technology Commercialization	1998	2001	USU
	Rapid Microbe	1998	2003	USU
	Signal Processing	1986	1990	BYU
	X-Ray Imaging	1987	1992	BYU
	Applied Molecular Genetics	1995	1998	BYU
	Chemical Technology	1989	1995	Weber State
	Bioremediation	1996	2003	Weber State
Software and IT	Base Education Technologies	1987	1988	U of U

Communications Research	1986	1990	U of U
Inverse Problems, Imaging & Tomography	1989	1993	U of U
Software Science	1989	1994	U of U
Supercomputing	1988	1992	U of U
VLSI Design	1990	1992	U of U
Asynchronous Circuits	1997	2000	U of U
Computer Graphics & Scientific Visualization	1990	1996	U of U
Design Systems	1995	1996	U of U
Electronic Systems Technology	1995	1999	U of U
Industrial Imaging	1996	1999	U of U
MTV Flat Panel Display Technology	1995	1997	U of U
Multimedia Education & Technology - U of U	1993	1997	U of U
Scientific Computing & Imaging	1996	2000	U of U
Electronic Medical Education	1999	2004	U of U
Global Knowledge Management	2003	2005	U of U
Interactive Ray-Tracing & Photo-Realistic Visualization	2005	Currently funded	U of U
Multi-Dimensional Information --CROMDI	2000	2005	U of U
Organic Electronics	2006	Currently funded	U of U
Computer Networks	1987	1989	USU
Information Technologies (handicapped Education)	1988	1991	USU
Magnetism in Information Technology	1995	1996	USU
High speed information processing- CHIP	2002	2006	USU
Computer Integrated Manufacturing	1987	1989	BYU
Parallel Supercomputing	1988	1989	BYU
Computer Based Education	1987	1991	BYU
Acoustics Research	2005	Currently funded	BYU
Advanced Communications Technology	2004	Currently funded	BYU
Intelligent Computer Tools	1996	2001	BYU
Multimedia Education & Technology - UVSC	1992	1995	Weber State
3D Computer Graphics / 3 D Software	1990	1996	Dixie State

Spin Out Companies

By Center

SCHOOL	CENTER	COMPANY	STATUS
DIXIE	3D Computer Graphics	AK international	Dead
		Illustrative Impressions	Dead
		InfoWest	Live
		NetEx	Dead
		Paintbrush Productions	Dead
BYU	ACERC	Combustion Resources	Live
		Reaction Engineering Intl	Live
BYU	Advanced Composites	Rocky Mtn. Composites	Live
BYU	Advanced Joining of Materials	Megastir	Acquired
BYU	Advanced Structural Composites	IsoTruss	Live
		Patterned Fiber Composites	Dead

		TauRuss	Dead
WSU	Aerospace Technology	One Stop Satellite Solutions Inc.	Dead
		Wasatch Aerospace Co.	Dead
U/U	Alternate Strategies for Parasite Removal	Larada Sciences	Live
U/U	Artificial Hearts and Biomedical Devices	Medquest Manufacturing	Dead
		Medquest Products	Acquired
		Utah Artificial Heart Institute	Live
U/U	Base Technical Education	Assessment Co.	Dead
		Software Co.	Dead
U/U	Biomedical Microfluidics	Wasatch Microfluidics	Live
U/U	Biomedical Optics	Carroderm	Acquired
		Nutriscan	Acquired
		Spectratek	Dead
U/U	Biomolecular Technologies	GenMetrix, LLC	Live
U/U	Biopolymers at Interfaces	HCP Diagnostics	Dead
		Protein Solutions, Inc.	Dead
WSU	Bioremediation	Applied Biosciences Corp.	Acquired
USU	Biotechnology	Intech One-Eighty Corp.	Live
U/U	Cancer Genetic Epidemiology	Myriad Genetics	Live
U/U	Cell Signaling	Echelon Research Laboratories Inc.	Live
		Salus Therapeutics	Acquired
BYU	Chemical Separations	IBC Advanced Technologies	Live
WSU	Chemical Technology	Linco Technology (now First Scientific)	Dead
U/U	Coal Research	FemtoScan Corp.	Live
		International Resin Resources	Dead
U/U	Computational Design and Testing	Visco	Live
USU	Computer Aided Engineering Design	CIMETRIX	Live
		Design Synthesis	Dead
		PROMODEL Co.	Live
BYU	Computer Based Education	Cali, Inc. (became Ellis, then acquired by Pearson)	Acquired
U/U	Computer Graphics & Scientific Visualization	Engineering & Geometry Systems	Live
BYU	Computer Integrated Manufacturing	CAM Software	Dead
		CIM Training Center	Dead
		EDGE Foundation	Dead
		EDGE Inc.	Dead
		Ozone Saver Industries	Dead
		Smartware	Dead
		Utah PODS Manufacturing Co-op	Dead
U/U	Controlled Chemical Delivery	Insutech became MacroMed	Live
U/U	CROMDI	Applied Medical Visualization, Inc.	Live
USU	Dairy Foods Technology	Dairy Research Consulting of Utah	Dead
		Food Research & Dev Group	Dead
		Utah Milk Technology	Dead
U/U	Design of Molecular Function	Envirol	Acquired
		MicroBioSystems	Live
		Whetstone	Dead
U/U	Design Systems	ErgoWeb	Live
		Part.Net (Medibuy)	Live
USU	Developmental & Molecular Biology	PanGenics, Inc.	Dead

U/U	Direct Machining and Control	Direct Controls	Live
U/U	Electronic Medical Education	Amirsys	Live
		Global Matics	Acquired
		Visual Share	Live
U/U	Electronic Systems Technology	Bonneville Technologies	Dead
		HDG	Dead
U/U	Engineering Design	Animate Systems	Dead
		MicroJect, Inc.	Dead
		Sarcos Medical Corporation	Live
USU	Genetic Improvement of Livestock	Livestock Molecular Research & Development Inc.	Acquired
U/U	Genome Technologies	Cimmeron Software	Live
U/U	Harsh Environment Electronics (formerly MTV Flat Panel)	Innosys	Dead
		Radiant Labs	Dead
USU	High Speed Information Processing	SP Communications	Live
U/U	Industrial Imaging	GeoChem Metrix, Inc.	Live
USU	Information Technology (Handicapped)	Effective Instructional Technologies	Live
U/U	Inverse Imaging & Tomography	Monolithic Tech	Dead
		TechniScan	Live
USU	Meat Processing Technology	Canyon Rayas	Dead
		Mountain Lamb (land?) Co-op	Dead
		Timpanogos Meats	Dead
U/U	MicroArray Technology	Sigma Technology Holding Company- now Philotek	Live
U/U	Minerals Technology	Milltech Engineering	Live
		Mineral Technologies Inc.	Live
BYU	Miniature Unmanned Air Vehicles	Flying Sensors	Live
		Procerus Technologis	Live
U/U	Modified Activated Carbons Technology	INOTECH	Live
UVSC	MultiMedia Ed & Tech (UVSC)	Cela Solutions Inc.	Dead
		MC2	Dead
		Memory Lane Productions	Dead
		Utah Valley On-Line	Dead
U/U	Neural Interfaces	Bionic Technologies Inc.	Live
U/U	Nuclear, Medical, and Environmental Technology	Nuclear Labyrinth	Live
USU	Profitable Uses of Agricultural Byproducts	Andigen	Live
U/U	Quality and Integrity Design	FASIDE Itnl, Inc.	Live
		Holsip	Live
U/U	Raman Scattering	Process Instruments	Live
USU	Rapid Microbe Detection	Bio Matrix Solutions	Dead
		Finite Technologies	Live
	Rapid Prototyping	Unknown Name	Dead
U/U	Scientific Computing & Imaging	Visual Influence Inc.	Live
USU	Self Organizing Intelligent Systems	Autonomous Solutions Inc. (ASI)	Live
		Kachemak Research and Development	Live - Out of State
		Monetary Services Inc.	Dead
		Visionary Products	Live
BYU	Signal Processing	ASTECH	Dead
		Deseret Digital Designs	Dead
		Sonic Innovations	Live

		Vector Technologies	Dead
U/U	Smart Sensors	Live Wire	Live
		RF Innovations	Live
U/U	Software Science	Hippo Software, Inc.	Dead
BYU	Solid Oxide Fuel Cells	Materials and Systems Research, Inc. (MSRI)	Live
		Versa Power Systems (VPS)	Live - Out of State
USU	Space Engineering	CXT, Inc.	Dead
		Globesat Holding Co.	Dead
		ICOMP, Inc.	Dead
		Interactive Resources Co.	Dead
		Medcom, Inc.	Dead
USU	Supercritical Fluid	Lee Scientific	Acquired
U/U	Therapeutic Biomaterials	Glycosan Bio	Live
		Sentrx Animal Care	Live
		Sentrx Surgical - now Carbylan Biosurgery	Live - Out of State
USU	Value Added Seed Technology	F1 Technologies	Dead
USU	Vascluar Biosciences	Hydra Bioscience	Dead - Formed Out of State
U/U	VLSI Design	Bonneville Microelectronics	Dead
BYU	X-RAY Imaging	MOXTEK	Live

Appendix A – Centers of Excellence Summaries

Aerospace Cluster

Center for ADVANCED SATELLITE MANUFACTURING	
The Center for Advanced Satellite Manufacturing is seeking to create a viable Utah-based satellite manufacturing enterprise based upon years of expertise and projects within Utah State University and its Space Dynamics Laboratory. The Center is pursuing the development of novel advanced manufacturing and design techniques to reduce the cost and time involved with satellite manufacturing while improving quality and performance.	*USU* *Funded 2004-* Brent Stucker (435) 797-8173 brent.stucker@usu.edu

Center for AEROSPACE SCIENCE TECHNOLOGY	
The center focuses on the development of small, low-earth orbiting satellites and related aerospace technology. The center exploits opportunities with expertise developed in the design, manufacture, and operation of small satellites to commercialize technologies.	*WEBER STATE* *Funded 1987-1992* Robert J. Twiggs (650) 723-8651 Bob.Twiggs@Stanford.edu
• The Center has developed and flown two satellites: NUSAT I and WEBERSAT; receiving world-wide recognition as a leader in small satellite development. • Some of the Center research was transferred to Stanford University with Twiggs, It is now being used to develop CUBESAT	**Spin Out Companies** • One Stop Satellite Solutions, Inc. • Wasatach Aerospace Co. **Benefiting Companies** • Intraspace, Inc. • Simulacrum, Inc. • Wasatch Research & Engineering

Center for MINIATURE UNMANNED AIR VEHICLES	
The Center focuses on the rapid design of airframes and miniaturized autopilot and guidance systems for tiny UAVs that can be operated by novices. The Center has earned the attention of both military and civilian agencies.	*BYU* *Funded 2004-* Tim McLain (801) 422-6537 mclain@byu.edu **Spin Out Companies** • Procerus Technologies • Flying Sensors

Center for SPACE ENGINEERING	
Established in 1986, the center is Utah's leader for new technology developments involving space remote and in-situ sensing systems, image compression technology and small satellite systems. Sensing equipment developed at the center was the primary experimental effort on a previous shuttle mission. Technologies include: • Infrared instrumentation • Sensor calibration • Upper atmosphere measurements & modeling • Plasma diagnostics • Data analysis • Image compression technology • Cryogenic systems • Program management • New technology developments in space remote and in-situ sensing systems	*USU* *Funded 1986-1992*
• Center has flown 350 payloads, 75 of which involved cryogenics • Joint composites projects with BYU Center and Hercules Corp. • Success of CIRRIS 1A experiment aboard space shuttle Discovery promises increased business opportunities	Dr. Frank Redd fjredd@usu.edu **Spin Out Companies** • CXT, Inc. • Globesat Holding Co. • ICOMP, Inc. • Interactive Resources Co. • Medcom, Inc. **Benefiting Companies** • Hercules • Thiokol • Space Dynamics Lab

Competitive Accelerators Cluster

Center for ADVANCED ARCHAEOLOGIC & PALEONTOLOGIC IMAGING & MODELING	
The center provides an opportunity to utilize leading edge technology to implement a revolutionary approach to the creation of museum reproductions, models and miniatures. The overall objective is to integrate CAD-CAM technologies in the areas of archaeology and paleontology	*College of Eastern Utah* *Funded 1992-1993*
• Remodeling of the Huntington Canyon Mammoth • Two recently discovered dinosaur species will be molded by the Center	Dr. Don Burge

Center for ADVANCED COMPOSITES MANUFACTURING & ENGINEERING	
Established as the focal point and coordinator of technical resources in Utah in the areas of composite materials, plastics, and other advanced materials. ACME assists existing industry and start-up companies and also conceives, invents, develops, and spins-out new and enhanced products into commercial enterprises.	*BYU* *Funded 1989-1995* Brent Strong (801) 422-7878 strongb@byu.edu **Spin Out Companies** • Advanced Laminate Technology • American Vitrolite • Baal • Emily Rose • Fiber Dynamics • Futura Propulsion Systems • IsoTruss • Merrell Enterprises • Rocky Mtn. Composites • Synergy Marketing **Benefiting Companies** • AeroTrans • American Polymer • Ashton Aerospace • Automated Process Control • B&M Enterprises • Beckwith Technology • Bemsco • BGA • Blue Cow, Inc. • Bradley Instruments • Creative Composites • Dimensional Research • CRP/Springlite • Curecrete • DAH Inc. • Delta Fiberglass • EDO • Evolution Skis • Fiber Tek • H K Corporation

	• Haelan Medical • Hexatron • Ideas to Products • INCO VaporFab • International Biokenetics • LCC Fabrications • Legends Technologies • MATCO • Medi-Sight • Medilight • Mountain High Engineering • Mountain Land Support • Performance Composites • Potter Management • Pro Design Corporation • Red Hawk, Inc. • Rotomolding of Utah • Sound Composites • Springlite • Terra Tek • TRA • Ultralite of America • UP International • Utah Rocketry • Van Patten Corporation • Wasatch Engineering • Wasatch Technology Group

Center for ADVANCED CONSTRUCTION MATERIALS

The center's major emphasis is in the development of new and recycled construction materials, and innovative techniques for inspecting the condition of constructed facilities. Core technologies include:

- Automated facilities management system (AFMS) to measure and analyze pavement cracks to schedule maintenance strategies
- Tire added latex concrete blocks, to use waste materials and to improve performance
- New construction product testing and evaluation services

- Two software modules, PicCrack and MapCrack have produced great results in four Utah cities

UU
Funded 1993-1994
1996-1997

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Benefiting Companies

- Green Hill Recycling
- Soil Stabilization Inc.
- uniAMS

Center for ADVANCED JOINING OF MATERIALS

The Center for Advanced Joining of Materials (CAJM) is developing enhancements and new technologies based on friction stir welding (FSW). FSW is a relatively new, innovative joining technology which is revolutionizing the way in which aluminum, copper and other materials are being joined. The objectives are to develop enhancements to this existing technology that will broaden the use of this process in new materials and applications, and to transfer these technologies to
local, national and international companies.

The Center has been focused on the development and marketing of three technological aspects of FSW:

- Tooling that will last longer, offer the ability to join a wider range of advanced materials, and enable better control of the resulting quality of the weld and its properties
- New control systems and hardware for large scale, three-dimensional FSW capabilities
- New methods and novel tooling for joining polymeric materials

- 11 pending and 2 issued patents
- Utah spin-out company Megastir

BYU
Funded 2000-2004

Tracy Nelson, Ph. D.
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Spin Out Companies

- Megastir

Benefiting Companies

- Advanced Metal Products

Center for ADVANCED MATERIALS & MICROELECTRONICS	
	UU *Funded 1987-1992*
	Gerald B. Stringfellow (801) 581-8387 stringfellow@coe.utah.edu
This center provided unique testing facilities, technical expertise and problem solving assistance to Utah industry. Composite, ceramic and semiconductor materials were explored for structural, aerospace and electronic applications. Technologies included: • Multiple layer epitaxy • III/V compound chip design • Ceramics as solid electrolytes and structural components • Composite materials • Organometallic vapor phase epitaxy	**Benefiting Companies** • Beta Power, Inc. • Bonneville Microelectronics • Ceramatec • Concoyle Oilfield Tools, Inc. • Edo Western • Evans & Sutherland • Fisher Co. • Hercules • Nova Tech • Space Systems Engineering • Thiokol • Westcott Co.

Center for ADVANCED STRUCTURAL COMPOSITES

BYU
Funded 1999-2004

David W. Jensen
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The objective of the Center for Advanced Structural Composites is to commercialize the IsoTruss technology. The IsoTruss enables the creation of super lightweight grid structures with the potential for revolutionizing industries as diverse as civil infrastructure (e.g., communication and construction), aerospace, automotive, marine and sporting structures and virtually any application area requiring high strength, high stiffness, light weight and superb corrosion resistance.

The core technology consists of an ultra-lightweight composite structural shape known as the IsoTruss. The IsoTruss is a novel, patented, three-dimensional structural form that takes advantage of the highly directional properties of high strength composites to produce an extremely efficient and lightweight structure. The IsoTruss incorporates stable geometric configurations with helical members that spiral in opposing directions around a central cavity, coupled with longitudinal members that pass through the intersections.

- Spin-out IsoTruss Structures Inc., is selling products, aiming to first displace wooden utility poles.
- Conventional poles weigh half a ton and last 5-40 years, while IsoTruss poles weigh 300 pounds and are expected to last 60-100 years for the same price, while costing less to transport and install.

Spin Out Companies

- IsoTruss
- Patterned Fiber Composites, Inc
- TauRuss

Center for APPLICATIONS FOR MATERIALS ENGINEERING

BYU
Funded 1996-1997

Paul Eastman
(801) 422-2759
paul_eastman@byu.edu

The center was an important resource in Utah for technical knowledge and capability in the areas of plastics, composite materials and metallurgy. The center assists existing start-up companies and also conceives, invents, develops and spins off into commercial enterprises new or enhanced products. The center has patented the following technologies:

- Cure and contamination sensing devices
- Damping of composites through unique orientation of fibers
- Improvement of fiber binding on thermoplastic composites
- Forming technique for large thermoplastic composites

- Assisted 164 companies

Center for CHEMICAL REACTORS	
The center focused on the development of fluid-bed technology for catalytic reactions and biological leaching technology for recovery of gold from refractory ores.	*UU* *Funded 1989-1990*
	A Lamont Tyler lamont.tyler@m.cc.utah.edu
	Benefiting Companies • Kennecott • EIMCO
• Biological leaching of refractory gold ores supported by Kennecott and EIMCO	

Center for CHEMICAL SEPARATION	
Researchers with backgrounds in organic chemistry, inorganic chemistry and chemical engineering studied the full development of a new ligand bonded silica gel technology. The resulting products are used in a variety of separation systems. A few applications of center technology include precious and base metal refining, heavy metal and organic clean-up and nuclear waste management. .	*BYU* *Funded 1987-1992*
	Dr. Reed Izatt (801) 422-2315 reed_izatt@byu.edu
	Spin Out Companies • IBC Advanced Technologies **Benefiting Companies** • ASARCO • Cascade Refining • DataChem • GalTech Semiconductor • Johnson Matthey • Parish Chemical • Tronac, Inc.
• Set up pilot plants in four of the largest precious metal refineries in the U.S. • Processes for separating Paladium and Rhodium represents a 40%-60% cost reduction to the industry	

Center for COMPLIANT MECHANISMS

BYU
Funded 2000-2003

Larry L. Howell Co-PI
(801) 422-8037
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The objective of the Center for Compliant Mechanisms is to direct the development and commercialization of compliant mechanism technologies and associated product applications so that they can be effectively licensed to existing or new companies in Utah. The Center also seeks to develop approaches that will accelerate this development, and promote co-development with interested Utah companies.

Compliant mechanisms are devices that obtain their motion from the deflection of flexible component parts rather than pin joints, thus offering advantages of lower manufacturing costs (reduced part count, elimination of assembly), increased performance (reduced friction, increased precision, reduced weight, etc.), and ability to miniaturize (including microelectromechanical systems). Brigham Young University is a recognized leader in compliant mechanisms and is uniquely poised for helping companies exploit the advantages of compliant mechanisms.

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- 12 patents issued and 4 pending
- “Near Constant-Force Electrical Contact,” patented and exclusively licensed to ATL, Springville, Utah.
- "Compliant, Ortho-Planar, Linear Motion Spring,” patented and non-exclusive license for a specific application granted to Flowserve, Springville, Utah.
- "Continuously Variable Transmission,” patented and exclusively licensed to Recreational Systems, Inc., Kaysville, Utah

Benefiting Companies

- ATL
- ICON
- MityLite
- Grandway USA
- Flowserve
- Recreation Systems

Center for COMPOSITES IN CONSTRUCTION

The Center has a primary focus on composite materials that may be used to strengthen or reinforce precast concrete structures such as bridge columns, freeway overpass beams, concrete walls and other structural components. The basic technology utilizes fiber-reinforced polymers woven into industrial fabrics that can be used to wrap structures or be imbedded in precast concrete designs.

The Center develops design guidelines and specifications for the strengthening of columns and seismic retrofit of bridge caps and joints with FRP composites.

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- The Center has developed a patent application for “Fiber Reinforced Polymer" (FRP) composite connections of precast concrete walls.
- More than 70 columns of I-80 bridges will be retrofitted with the composite wraps.
- In addition, the State Street bridge on I-80 will get a seismic retrofit using FRP composites.

UU
Funded 1998-1999

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Benefiting Companies

- Thiokol
- Waterpoint
- Monroc, Inc (Eagle Precast Co.)
- EDO Fiber Science
- Sika
- Hydrotech

Center for COMPUTATIONAL DESIGN AND TESTING

The objective of this new Center is to commercialize computational engines that facilitate and accelerate the design and testing of novel materials and device elements, with a special focus on nanostructured materials and devices.

The center is focused on two computational engines: Materials Designer (MaDes) and Device Simulator (DeSim). The algorithms of MaDes predict the structural and mechanical properties of new materials based on first principles analysis at the level of atomic forces, while De- Sim models the electrical properties and performance of components constructed with novel materials.

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- A patent is now pending on the design for a carbon nanotube electromechanical pressure sensor
- A web based user interface for on-line computational applications has been successfully demonstrated

UU
Funded 2002-2004

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Spin Out Companies

- Visco

Benefiting Companies

- Fairchild Semiconductor

Center for COMPUTER AIDED ENGINEERING, DESIGN & MANUFACTURING

The center's focus is research in computerized drafting, 3-D design, solid modeling, finite element modeling, numerical controlled mfg, robotics, facilities management, plant monitoring and control, database management and inventory planning.

The center has developed six software products:

- Promodel
- ROBLINE
- OPTDESX
- CATS
- Movie(c-Quel.byu and movistar.byu)
- MAXXICAD
- GEOSOLID.BYU

.

- Products are marketed exclusively through three spin-out companies
- Over 1,600 licensed users of Center generated software

BYU
Funded 1988-1992

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Spin Out Companies

- CIMETRIX
- PROMODEL Corp
- Design Synthesis

Benefiting Companies

- AgriDyne Technologies
- Albion Technologies
- Arrow Dynamics
- Artistic Precision Enterprises
- Bel Viso Labs
- Vuena Ventura
- Bureau of Mines
- C.T. Film, In c.
- Cache Valley Cheese
- Chromalox
- Del Med, Inc.
- Evans & Sutherland
- Great Basin Brine Shrimp
- Great Salt Lake Mineral
- Hercules
- Hewlett-Packard
- Hill AFB
- Industrial Research
- IOMEGA
- KEMGAS
- Miller Labs
- Morton Automotive
- Reilly Wendover
- Schreiber Foods, Inc.
- Solaray
- SusumuConstruction
- Thiokol
- Trysan
- VALTEK
- Viewpoint Animation
- Western Zirconium
- Williams International

Center for CONTROL OF FLOW IN MANUFACTURING	
The Center is applying flow control technology to improve manufacturing processing including particle sorting and thermal sprays. This Center was assigned a business team in 2005-06.	*USU* *Funded 2006-* Barton Smith (435) 797-3278 barton.smith@usu.edu

Center for DIRECT MACHINING AND CONTROL (DMAC)	
This Center is commercializing a disruptive technology for manufacturing: A new paradigm of one controller for many devices. That is, multiple machine tools can be run by one operator, through a network, rather than by individual operators. Instead of every machine having its own control panel, one program and one controller could theoretically manage all the machines within a plant—creating dramatic cost savings. A related application of the core technology (VMAC) is being developed for the home automation market. The DMAC technology is based on the development of an open architecture controller and supporting control algorithms for general control of advanced mechanisms such as 5-axis machine tools. This controller uses a dual CPU PC/controller so that the CAD/CAM application can run under Windows, while the real time control software can run under a second CPU. The motors and machine Input/ Output (I/O) are commanded over a high speed network such as fiber optic and IEEE 1394 (firewire). The control software consists of object oriented libraries that integrate motion planning, trajectory generation, servocontrol, communication, and user interfaces. .	*BYU* *Funded 2002-2005* Ed Red (801) 422-5539 ered5@comcast.net **Spin Out Companies** • Direct Controls, Inc.
• Four patents pending • Multiple contracts from major industrial partners.	

Center for ENGINEERING DESIGN	
The center exists to develop original solutions for technological challenges. By utilizing state-of-the-art equipment and research facilities, the CED can and will continue to bring innovative ideas in the form of superior products to the marketplace.	*UU* *Funded 1987-1993*
	Stephen Jacobsen (801) 581-6499 s.jacobsen@sarcos.com
• RDT (rotary displacement transducer) is an integrated chip-based rotary position encoder • The Dextrous Telescoping System surpasses the severly limited, traditional robotic manipulators	**Spin Out Companies** • Sarcos Medical **Benefiting Companies** • Animate Systems • MicroJet, Inc. • Sarcos Research Group

Center for FUNCTIONALLY GRADED AND DESIGNED CEMENTED TUNGSTEN CARBIDE AND POLYCRYSTALLINE DIAMOND COMPOSITE MATERIALS	
Advanced composite materials with predictable wear and failure characteristics designed for demanding applications such as mining, drilling, and grinding.	*UU* *Funded 2006-*
	Zak Fang (801) 581-8128 zfang@mines.utah.edu

Center for HARSH ENVIRONMENT ELECTRONICS	
The Center for Harsh Environment Electronics (formerly the Center for Flat Panel Displays) developed micro-miniature thermionic vacuum emitter (MTV) display panels. As the MTV technology matured and license agreements were signed, the center moved its focus to electronic circuits and devices for operation in high temperature environments. The center also provided services in the following areas: prototype development and testing; development of high-temperature electronics based on MTV technology; and development of tools to test flat panel display technologies.	*UU* *Funded 1995-2000*
	Laurence P. Sadwick, Ph.D. (801) 581-8282 sadwick@ee.utah.edu
• Enhanced flat panel display was patented	**Spin Out Companies** • Innosys • Radiant Labs

Center for MAGNETIC SENSOR & ACTUATOR MATERIALS	
Working to commercialize a novel magnetostrictive alloy exhibiting a large physical effect in response to small magnetic fields, which may find use in applications from antilock brakes to nanomachining and ultrasonic devices.	*UU* *Funded 2005-*
	Sivarman Guruswamy (801) 581-7217 sguruswa@mines.utah.edu

Center for NANOSIZE INORGANIC MATERIAL POWDERS

Commercializing a novel, cost-effective process (molecular decomposition) for the manufacturing of nanosize powders, the building blocks for myriad nanotechnology applications, as well as nanostructured ceramic membranes and other devices.

The main focus of this new Center has been to synthesize nanosize oxide powders by a low-cost, commercially scalable process using low-cost precursors. These powders find applications in numerous technologies. During the past year, one patent application was filed and one patent was issued. During the year, the use of nanosize powders in sensors and as a material for fuel cells, an energy conversion device which converts chemical energy of fuels directly into electricity was explored.

- One venture will be started this year. Fact Sheet has been sent to over 130 potential clients.
- ZrO2, CeO2: Fuel cells, structural ceramic components. Cells to be supplied to Versa Power Systems and FuelCell Energy this year.
- TiO2, ZnO, SnO2: Optics, coatings. Samples supplied.
- Fe2O3, CeO2, TiO2: Environmental clean-up. Samples being evaluated by the MAC Center.

UU
Funded 2004-

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Benefiting Companies

- Versa Power Systems
- FuelCell Energy
- Materials and Systems Research, Inc. MSRI

Center for NOVEL TITANIUM BORIDE SURFACE HARDENING TECHNOLOGY

This Center is commercializing a novel method for hardening the surface of components fabricated from Titanium. Originally developed with government funding for use in creating lightweight Titanium armor, their approach for the first time makes this strong metal suitable for use in applications such as hip replacements, bearings and cutting tools where superior hardness coupled with wear resistance create a superior product.

- Two patents have been filed.
- License signed with Ortho Development Corporation, a Utah company, for the development and FDA validation of orthopedic implants using the TiB coating

UU
Funded 2003-

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Benefiting Companies

- Ortho Development Corp.

Center for ADVANCED PYROMETALLURGICAL TECHNOLOGY

The goal of the Center was to test the feasibility of a clean, pollution-free and energy efficient new technology for producing copper from the sulfide minerals.

The technology investigated at this Center was aimed at copper smelters which were using technologies that generated large amounts of sulfur dioxide emissions and were not efficient in terms of energy consumption. The industrial feasibility of a closed and continuous copper smelting technology based on bottom gas injection was evaluated and confirmed. The technology was proven to be technically sound and environmentally superb. During the Center project a patent on a entirely new and different technology on solvent extraction processes was developed: H. Y. Sohn, “Continuous Solvent Extraction with Bottom Gas Injection,” U.S. Patent No. 5,641, 462, June 24, 1997.

- Patent issued on new low pollution, energy efficient copper smelter technology.

UU
Funded 1988-1989

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Benefiting Companies

- Kennecott

Center for QUALITY AND INTEGRITY DESIGN

QIDEC was originally established with the goal of "developing additional knowledge and an improved engineering educational system to help prevent our loss of manufacturing capability and decrease our liability problems related to failures" within the engineering community in the U.S. The center expanded the goal to address the shorter tem needs of industry and government in their increasing efforts to regain control over technical issues affecting product quality, safety and reliability, and organizational productivity. Work is centered on three major industrial sectors:

1. Medical device reliability
2. Aircraft and aerospace structural integrity
3. Structural fatigue and reliability of mechanical systems

- License agreements with FASIDE Int'l and Technology Management Assoc.

UU
Funded 1989-1991

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Spin Out Companies

- FASIDE International
- HOLSIP (organization)

Benefiting Companies

- Technology Management Associates

Center for RAMAN TECHNOLOGY

This center was established to commercialize Raman technology for chemical monitoring in natural gas, metal processing, and medical applications. Advances in instrumentation have made Raman scattering attractive as a general purpose analytical technique for measuring chemicals in sold, liquid and gaseous samples. Raman spectroscopy is the measurement of the wavelength and intensity of inelastically scattered light from molecules. The Raman scattered light occurs at wavelengths that are shifted from the incident light by the energies of molecular vibrations. Typical applications are in structure determination, multicomponent qualitative analysis, and quantitative analysis. Technology development is focuses on the following areas:

- Laser diode configuration
- Sample handling schemes
- Fiber coupling techniques
- Data-analysis algorithms
- Modifications to the core Raman detection systems.

- Patented laser (U.S. Patent No. 6,100,975), spectrograph (U.S. Patent No. 6,028,667), and 18 channel multiplexer (U.S. Patent No. 6,859,581)
- Process Instruments has its Raman systems in some of the largest refinery and petrochemical plants in the U.S.

UU
Funded 1996-1998

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Spin Out Companies

- Process Instruments, Inc.

Center for RAPID PRODUCT REALIZATION	
The center was established to provide manufacturing technology extension services designed to assist small manufacturing companies, to bridge the gap between new product concepts and manufacturing realization, and to develop innovative technologies which will result in products, patents, and related economic benefits for the state. The center went on to become Utah's Manufacturing Extension Partnership.	*BYU* *Funded 1993-1996* David Sorensen and Brent Strong (801) 863-7901 dsorensen@mep.org
• Assisted over 171 individuals and companies with new product development, prototyping and testing.	**Benefiting Companies** • Accuserve • American International • Bolick, Co. • CellTek, Int'l • GWH • Hatch Biomedical • Tile Roof Associates • Manufacturing Extension Program • Youth Reclamation, Inc.

Center for RAPID PROTOTYPING

The Center for Rapid Prototyping is focused on commercializing technologies related to ultrasonic sensing for injection molding processes, and physical and virtual geometric modeling for computer aided design.

The Center has been working on multiple projects, including:

- Machining techniques that allow the prototyping of geometric objects of arbitrary complexity on a 3 axis CNC mill with limited tools and little operator skill required
- A series of new sensors and controls for improved polymer processing
- Personal Prototyping System (PPS) that makes rapid prototyping affordable for small companies and perhaps even the average consumer
- Low cost 3-D scanning technologies that make the acquisition of 3-D geometric data practical and affordable for reverse engineering, medical imaging/reconstruction, etc
- A device that is capable of producing very large prototypes (Shapemaker)
- A photopolymer-based technique to create prototypes in a single step (Inverse Tomographic Construction)
- New micro and nano-scale polymer manufacturing techniques have been developed, including a micro-forging technique and a nanoscale injection molding machine.

- Production of the first micro-scale injection molded parts
- Completion and testing of a production-type prototype high temperature ultrasound transducer and control system
- Production and test marketing of individualized replicas of human faces captured in a polymer based collectible
- One spin-off company already formed.

UU
Funded 2001-2004

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Benefiting Companies

- Accuserve
- American International
- Bolick, Co.
- CellTek, Int'l
- GWH
- Hatch Biomedical
- Tile Roof Associates
- Manufacturing Extension Program
- Youth Reclamation, Inc.

Center for THERMAL MANAGEMENT TECHNOLOGIES	
Technologies for extremely high performance thermal management in the context of physical and vibration isolation, in part from collaboration with Utah State University's Space Dynamics Lab.	*USU* *Funded 2006-*
	Clair Batty (435) 881-1325 clairbatty@comcast.net
	Benefiting Companies
• Provision patent application in August 2006	• Starsys

Center for UTAH RESEARCH INSTITUTE	
The main focus of the Center was "Parts on Demand System (PODS)," a cooperative effort among Utah's largest universities to implement a paperless order and production process for small parts. Combined resources have enabled URI to successfully compete for military and industrial contracts.	*UU, USU, BYU, WSU* *Funded 1988-1992*
• $4.5M contract for CALS/PODS program at Ogden Air Logistics Command • $380K contract to provide software engineering services to the Air Force Software Technology Support Center. • $3.7M contract to help develop, test and install a Spare Parts Productions and Reprocurement System (SPARES) for Ogden Air Logistics Center.	David Norton dave.norton@usurf.usu.edu

Defense and Homeland Security Cluster

Center for ADVANCED IMAGING LADAR	
The Center for Advanced Imaging LADAR was formed to commercialize a now patented camera technique that uniquely combines laser distance measurement with digital color imaging, resulting in detailed, 3-D color images that can be captured in real time and also stored for later analysis and manipulation in virtual reality environments. Civilian and military markets exist for stationary, airborne and spaceborne versions of the technology. CAIL's technology couples existing 3D LADAR (Laser Detection and Ranging) technology with 2D digital color imaging in the unique 3D Texel Camera. Previously, distance and spectral datasets had to be collected separately, carefully registered, and then superimposed – laborious reprocessing that often required days to weeks. The CAIL technology works in real time – the first system to enable precise 3D color imaging when either the scene, the camera or both are moving.	*USU* *Funded 2003-* Robert T. Pack (435) 797-7049 rtpack@cc.usu.edu **Benefiting Companies** • InteliSum (Rapidmapper)
• Key Patent Issued • Utah company InteliSum is marketing land based LADAR system	

Center for SELF ORGANIZING & INTELLIGENT SYSTEMS	
The center provides design services to Utah companies to develop intelligent systems solutions for new and improved commercial products. The center maintains a national and international reputation as a leading contributor to the advancement of intelligent systems research. Intelligent systems include any device and/or software concept which attempts to artificially emulate the unique cognizance and control abilities of the human mind.	*USU* *Funded 1992-2000* Kevin Moore, Ph.D. snowvax@cc.usu.edu **Spin Out Companies** • Autonomous Solutions Inc. • Kachemak Research and Development • Monetary Services, Inc. • Visionary Products Inc.
• Leader in Unmanned Ground Vehicles (UGVs) • $4MM in defense contracts • Research contract with nation's largest agricultural equipment manufacturer	

Center for SMART SENSORS

In a general sense, Smart Sensors meld sensor, signal processing, and computer technologies to create new functionalities such as the ability to probe the environment and modify sensor function in order to improve their data gathering capability. Applications envisioned by this Center span medicine, precision agriculture, electronics manufacturing, wireless communication, transportation and radar.

The Center for Smart Sensors focuses on two core technologies which have the greatest commercial potential:

- Circuitry for measuring length, distance or impedance; this enables a Smart Wire inspection system that can detect and locate faults or insulation breaks in aircraft wiring in real time.
- Imbedded Microstrip Antenna (IMA), which can sense or communicate in a buried environment.

Both families of technologies are based on simple ideas and simple circuits that result in two critical characteristics -- Small and Cheap. This makes them applicable to a wide array of applications.

- Single IMA antenna can both sense and communicate
- 12 pending patents
- 1 issued patent
- Commercialization of aircraft wiring fault detection has over $1MM in funding from FAA and aircraft firms

USU/UU
Funded 2000-2005

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Spin Out Companies

- LiveWire Test Labs, Inc.
- RF Sensor Innovations

Energy and Natural Resources

Center for ACOUSTIC COOLING	
The Center for Acoustic Cooling Technologies was originally established to commercialize novel high frequency thermoacoustic engines for cooling applications. One important application for this technology is in the heat management of computers and other devices employing dense arrays of microcircuits. Subsequent work has resulted in the demonstration of a prototype device capable of converting heat into electricity at high efficiency. The Center for Acoustic Cooling is leveraging fundamental developments in miniature thermo-acoustic devices supported by the Office of Naval Research and DARPA. The Center's technology is based on two effects in thermo acoustics: The first is that heat can be converted into sound energy, and the second is that sound can pump heat. Both have been employed in devices with dimensions ranging from 4 cm to 0.8 cm. Piezoelectric materials have now been incorporated in order to recover electricity in some cases.	*UU* *Funded 2000-2004* Orest G. Symko 801-581-6132 orest@physics.utah.edu **Benefiting Companies** • Coen Co. • Parvus Co.
• Intel and HP interested in acoustic refrigerator • Involved in $27MM DoD project with Washington State and University of Mississippi	

Center for ADVANCED COMBUSTION ENGINEERING & RESEARCH

Established in 1986 as a joint collaboration between Brigham Young University and the University of Utah for the purpose of advancing combustion engineering research, education, and technology. The principle focus is on clean and efficient use of fossil fuels including coal, oil, and natural gas as well as the combustion of toxic and municipal solid wastes. The center research program consists of 35 active research projects among 62 participants focused on 6 thrust areas.

The nation's basic and high-technology industries rely upon the adequate supply of high-quality energy, the production of which depends upon combustion technology. The international competitiveness of these industries depends in part on their ability to more efficiently use low-cost fuel resources such as coal, heavy oil, oil shale, and tar sands, which are abundantly available in the western United States and particularly in Utah.

Specific center technologies include:

- Mechanisms of fossil-fuel combustion and pollutant and soot formation
- The relationship between fuel properties and conversion
- Computer models to control and record the performance of particular combustion chambers
- Pollution formation/control and waste incineration

- The center is one of 18 highly sought-after national engineering centers.
- More than 60 licensing agreements
- Provides ongoing consulting services to Utah companies

BYU
Funded 1987-1995

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Spin Out Companies

- Combustion Resources
- Reaction Engineering Intl.

Benefiting Companies

- Animate Systems
- Combustion Services Inc.
- Ford, Bacon, Davis
- Geneva Steel
- GMH Engineering
- Hercules
- IOMED
- Pacific Corp.
- Questar
- Sarcos Research Corp Sarcos, Inc
- Thiokol
- Utah Power & Light

Center for COAL AND OIL RESEARCH	
The main focus of the center is the development of new markets for Utah coals and their products. The center promotes efforts to bring university and industry researchers together to develop and implement advanced methods of processing, upgrading, and preparing Utah coal and tar sand resources including coal/water slurry transport, differential liquefaction and resin extraction.	*UU* *Funded 1987-1991*
	Dr. Larry Andersen larry.anderson@utah.edu
• Nine patents issued	**Spin Out Companies** • FemtoScan Corp. • International Resin Resources **Benefiting Companies** • Advanced Processing Technology

Center for COAL PROCESSING TECHNOLOGY	
The center was established to provide the advanced processing technology required to extract coal resins economically and promote the development of a coal resin industry in Utah. The center has three proprietary technologies which will have applicability to Utah's coal industry • Processing technologies for the efficient retrieval and refining of organic resins from coal • X-ray CT technology for the analysis of coal wash-ability • Methods for cleaning coal and the development of air-sparged hydrocyclone technology	*UU* *Funded 1996-1998*
	J.D. Miller (801) 581-5160 jdmiller@mines.utah.edu
	Benefiting Companies • TerraTek

Center for MINERALS TECHNOLOGY

The Center's focus is on developing new technologies for minerals processing. Specific areas of expertise include the design of high efficiency grinding mills using state of the art computer simulation software, advanced mill analysis and monitoring methods, technologies for the in-line monitoring and measurement of particle size on moving conveyor belts, and the real-time control of industrial milling processes.

Computer software, on-line instruments and laboratory procedures for the design, monitoring, control and analysis of industrial grinding machines and operating mineral recovery plants have been demonstrated and are now available for application in industry.

- An instrument to measure the distribution of sizes of particles on moving conveyor belts has been developed and successfully tested at industrial sites.
- Millsoft software was sold to Process Engineering Resources, Inc., a Utah company.

UU
Funded 1995-1999

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Spin Out Companies

- Mineral Tehnologies, Inc.
- Milltech Engineering

Benefiting Companies

- Process Engineering Resources, Inc.

Center for MODIFIED ACTIVATED CARBONS TECHNOLOGY

The Center is focused on modifications to existing activated carbon products and expanding into new products based on modifications to various organic (carbon) materials.

- Technology #1: Magnetic activated carbons
- Technology #2: Biological modified activated carbon
- Technology #3: Inorganic modified activated carbon

All current technologies deal with removal of materials from fluid streams.

UU
Funded 2005-

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Spin Out Companies

- Inotech

Benefiting Companies

- Benefiting Co

Center for PETROLEUM RESEARCH

UU
Funded 2000-2005

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The Petroleum Research Center (PERC), which is an integral part of the Department of Chemical and Fuels Engineering at the University of Utah, is developing practical, cost-effective solutions to liquid hydrocarbon production, handling and transportation. PERC specifically works to understand problems related to the production, transportation and processing of waxy and asphaltenic crude oils, and alleviate those problems by developing a variety of methods and software tools (models) for the efficient and optimal production of oil and gas from underground reservoirs.

The Center is commercializing products in three areas:

- Flow Assurance (tools to help keep oil products moving through pipelines)
- Oil Simulants (environmentally safe yet accurate substitutes for crude oil)
- Reservoir Simulators (finite-element models for optimizing production from geometrically complex oil and gas fields)

With funding from the U.S. DOE and the petroleum industry, the PERC coordinates basic and applied research in the physical properties and physical and chemical thermodynamics of naturally occurring hydrocarbons.

- 2 patents issued on Oil Simulants
- Pursuing copyrights on several software products - Chemometric Database and Finite Element Reservoir Simulator

Benefiting Companies

- Systems Engineering and Simulation
- LT Industries
- Trans Alaskan Pipeline
- Exxon Mobil

Center for PROFITABLE USES OF AGRICULTURAL BYPRODUCTS

The Center for Profitable Use of Agricultural Byproducts was established to commercialize technologies utilizing agricultural production and processing byproducts. Waste materials of little or no value are transformed into energy and other salable items using technology developed at the center.

The USU technology has two basic components: 1) an induced sludge bed anaerobic reactor that can produce energy (biogas) and soil amendment from manure and food processing waste, and 2) a high rate aerobic (drum composter based) bioreactor that make the system more cost effective, and the products produced by the process more valuable. The scalable, modular system is reliable and easily managed.

- At least three operational plants in Utah producing electricity.
- One of these generates enough electricity to power its own farm and put $1,000 worth of electricity back into the grid monthly.
- One issued and one pending patent.
- A new Utah company, Andigen, has been formed to build the anaerobic systems.

USU
Funded 2000-2004

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Spin Out Companies

- Andigen

Benefiting Companies

- Inrepid (ITR) - Idaho
- Agrimass – California
- HHE

Center for SOLID OXIDE FUEL CELL TECHNOLOGY

The center was established to develop solid oxide fuel cell (SOFC) technology for the direct conversion of chemical energy of a variety of fuels, such as natural gas, coal gas and other reformed logistic fuels, into electricity at a very high efficiency. Center technologies are based on the design and fabrication of novel, anode-supported solid oxide fuel cells with highly efficient electrodes that have a very low resistance. This concept makes it possible to develop a cost effective, compact power unit for direct conversion of chemical energy of fuels into electricity for remote and residential applications.

- Based on IP generated by the SOFC Center, a Fuel Cell Consortium was formed for commercialization of SOFC technology
- (MSRI) co-founded by the Center Director, won an Advanced Technology Project (ATP) from the Department of Commerce (DOC) totaling $2M
- 3 patents issued

UU
Funded 1996-2001

Prof. Anil V. Virkar
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Spin Out Companies

- Materials and Systems Research, Inc. (MSRI)
- Versa Power Systems

Benefiting Companies

- FuelCell Energy

Center for SOLID WASTE RECYCLING

The center was established to pursue realistic and comprehensive solutions designed to overcome the social and economic problems our environment faces in the elimination of solid waste. In conjunction with the Huntsman Environmental Research Center, research will focus on four areas:

- Recycling
- Improving air quality
- Degradability
- Conservation of trees

- Polymax 5000 Polystyrene Foam Densifier makes it economical to ship polystyrene to facilities where it can be recycled

USU
Funded 1990-1993

Reed M. Nielsen

Benefiting Companies

- Recycling Technologies Corp.
- Huntsman Chemical Corporation

Center for SOLVENT SEPARATION OF HEAVY OILS

The center is focused on the development of commercially viable applications and processes for exploiting Utah's reserves of heavy oil resources, and to continue its efforts in developing hydro chemical remediation processes. Development is concentrated in the following:

- Production of flux oil and adhesives from the Great Salt Lake Oil
- Cleaning of oil from contaminated soils
- Removal of waste oil from engine filters
- Production of high performance road asphalt from tar sand bitumen.

- Two license agreements
- 1 patent filed

Weber State
Funded 1996-1997

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Benefiting Companies

- Crown Energy
- Oasis Industries

Center for SUPERCRITICAL FLUID SEPARATIONS

The center provides a focal point for research and development, education and training in the area of chemical analysis where high resolution separation and high sensitivity detection are emphasized. Technologies:

- Supercritical fluid chromotography and extraction
- Radio frequency plasma detection
- Time-of-flight mass spectrometry
- Capillary chromotography and electrophoresis

- New technology for deactivating small diameter spherical silica packing materials in the pharmaceutical industry
- Director Milton L. Lee received **The R&D 100 Award** for the technologically most significant products developed nationally
- Transitioned to "Distinguished Center" in 1991

BYU
Funded 1987-1991

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Spin Out Companies

- Lee Scientific

Benefiting Companies

- Dionex Corp.
- Sensar Corp.

Life Sciences Cluster

Center for ALTERNATE STRATEGIES FOR PARASITE REMOVAL	
The center to commercialize a safe, nontoxic and rapid treatment for Pediculosis (head lice), a multibillion-dollar, increasingly resistant problem afflicting some 25% of children by the time they are teenagers. The Centers is currently testing a safe, effective, non-chemical treatment for head lice, Pediculus humanus. We have secured funding from Utah Centers of Excellence program and approval from the University of Utah Institutional Review Board to perform our treatment on children six and older, and adults in the Salt Lake Valley.	*UU* *Funded 2004-* Dale Clayton (801) 581-6482 clayton@biology.utah.edu **Spin Out Companies** • Larada Sciences

Center for APPLIED MOLECULAR GENETICS	
Useful DNA based probes are being evaluated. The technologies being developed for selecting DNA markers include: random amplified polymorphic DNA (RAPD), restriction fragment length polymorphisms (RFLP) and sequence characterized amplified regions (SCAR). The objective is to identify probes that correlate with useful qualitative and or quantitative traits. Swine markers showing correlations with specific traits are: back-fat (9), feed intake (4), and growth rate (11). The search for DNA markers in dairy cattle to correlate with milk and protein yield, has resulted in the identification of 3 useful markers.	*BYU* *Funded 1995 –1998* Robert L. Park, Ph.D. (801) 378-6871 robert_park@byu.edu
• DNA markers have been established for a serious disease (spontaneous cardiomyopathy) in turkeys, which could be used for the benefit of Utah's turkey industry.	

Center for ARTIFICIAL HEARTS AND BIOMEDICAL DEVICES

Established to develop the first electro-hydraulic artificial heart (an advanced version of the JARVIK-7) which utilizes a single energy converter and unified ventricles that will fit in humans. Other implant projects included the urinary bladder, urethra, ureter and a sphincter. The center's scope of research includes: conceptualization, prototype development, fabrication, bench and implant testing and assessment.

- Engineering-miniature hydraulics, device design, design analysis, CNC machining capability, computer machining capability, device fabrication, polymers, plastics, metallics and QA/QC
- Electrical design & fabrication
- Integrated circuits & VLSl
- Device testing
- Animal experimentation-surgery, radiology, hematology, immunology, biochemistry, pathology, device retrieval analysis

- Developed Rotary Blood Pump
- Involved in Pneumatic Heart Development

UU
Funded 1987-1992

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Spin Out Companies

- Medquest Products
- Medquest Manufacturing
- Utah Artificial Heart Center

Benefiting Companies

- St. Jude Medical
- CardioWest
- Symcardia

Center for BIOMEDICAL MICROFLUIDICS

The Center focuses on engineering technology that controls the movement of fluids in channels smaller than a human hair. Micropumps that can deliver tiny quantities of drugs and improved devices for DNA screening are some product examples.

UU
Funded 2004-

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Spin Out Companies

- Wasatch Microfluidics

Center for BIOMEDICAL OPTICS

UU
Funded 1999-2003

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The Center for Biomedical Optics was established to commercialize optical technologies for diagnosis, therapeutic treatment, and disease risk assessment in medicine. The center capitalized on advancements in laser materials and laser spectroscopy to enable noninvasive assessment.

The center developed several new optical laser instruments to detect antioxidants in living human tissue. Specifically, the instruments detect the concentration and spatial distribution of carotenoid compounds, which are a family of antioxidants thought to prevent a number of degenerative diseases.

One application allows for the detection of carotenoids in the human retina. This will be useful to assess a subject's risk for developing age-related macular degeneration, which is the leading cause of blindness in the elderly. In the past, no reliable noninvasive test procedure existed. The new laser detection technology makes it possible to noninvasively test the concentration and spatial distribution of antioxidants in the retina through undilated eyes within a fraction of a second. The test results provide the physician with valuable information regarding the health of the retina and potentially required intervention strategies.

Another application is the use of the technology to detect the level of antioxidants in the human body by taking a reading of skin carotenoid levels. A link exists between the level of antioxidants in the human body and the immune system, which is being researched.

- The success connected to the technology licensed by NuSkin Pharmanex has impacted Utah's economy with jobs and increased revenues, and also generated a significant annual royalty income stream to the University of Utah.
- The level of antioxidants in the eye and skin can now be measured using noninvasive techniques

Spin Out Companies

- Nutriscan
- Caroderm, Inc.
- Spectratek, LLC

Benefiting Companies

- NuSkin/Pharmanex

Center for BIOMOLECULAR TECHNOLOGIES

The center was established to develop and commercialize technologies aimed at improving the efficiency of detecting rearrangements in the human genome and reducing the high cost of genetic microarrays (i.e."gene chips") which are ideally suited to unraveling complex genetic information. Each of these aims to remove major technological impediments in the biotechnology and health fields. For example, the inefficient methods to detect chromosome rearrangements have hitherto limited their use in the early detection of cancer, environmental health, and population genetics, even though such rearrangements are known to provide important diagnostic information.

- Two patent applications have been filed

UU
Funded 1998-2000

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Spin Out Companies

- GenMetrix, LLC

Center for BIOPOLYMERS AT INTERFACES

The center was established to increase knowledge and understanding of the interaction of proteins, nucleic acids, and cells with synthetic surfaces. This mission is important to the development of artificial organs and implants, production of contact lenses and diagnostic devices, and for biotechnological process development.

- 11 patents issued
- 2 patent applications

UU
Funded 1986-1991

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Spin Out Companies

- Cell-Link (now Allvivo)
- Protein Solutions, Inc.

Benefiting Companies

- Becton Dickinson Critical Care Monitoring
- Cardiopulmonics, Inc
- Hyclone Labs
- Research Industries
- Silicon Graphics
- CIBA Vision

Center for BIOREMEDIATION	
The Center for Bioremediation develops, refines, and implements innovative biotechnologies for the removal of heavy metal and other inorganic contaminants. The Center's technology focus is biological selenium removal. Additional technologies include technologies for arsenic removal and cyanide degradation with an emphasis on enzymatic cyanide degradation.	*Weber State* *Funded 1996-2003* Jack Adams (801) 585-7349 jadams@mines.utah.edu
• Field-proven biotechnologies include Selenium reduction, Arsenic Reduction and Cyanide Biooxidation Technology. • The Center's technology has been demonstrated to be approximately 1/10 the cost of EPA's past BDAT and removes selenium to lower levels.	**Spin Out Companies** • Applied Biosciences **Benefiting Companies** • Non-invasive Geotracking - now called Willowstick

Center for BIOTECHNOLOGY	
The Center for Biotechnology was based on the phenomenon that fungi not only degrade organic materials, but inorganic materials as well. A technology was developed that breaks down pollutants such as TNT, DDT, and PCB. The process must be adapted based on where the chemicals are located, i.e., in soil or in water. If the pollution is in soil, the soil makeup and moisture content must be considered.	*USU* *Funded 1987-1992* Steven D. Aust (435) 797-2730 sdaust@cc.usu.edu
• Issued seven patents that provided for blanket environmental clean-up.	**Spin Out Companies** • INTECH One-eighty Corp. **Benefiting Companies** • Agridyne Technologies • EarthFAX • Natural Product Services

Center for CANCER GENETIC EPIDEMIOLOGY	
Established to study the genetic causes and origins of common cancers (e.g. breast, melanoma, colon, and prostate) and to develop DNA based diagnostics. Focus is on developing approaches to gene mapping and gene isolation for future applications in cancer diagnosis and therapy.	*UU* *Funded 1990-1995*
	Mark Skolnick (801) 584-3643 mark@myriad.com
• The Center has cloned the 17q linked breast cancer gene and the 9p linked melanoma gene. • Myriad Genetics employs 770 people with revenues of approximately $100MM	**Spin Out Companies** • Myriad Genetics

Center for CELL SIGNALING

Cell signaling consists of the set of biochemical interactions that mediate physiological changes within and between living cells. When a ligand binds to a receptor, for example, the interaction causes a biochemical response within the cell. Many diseases are associated with signaling pathways that have gone awry -- cancer, allergy, asthma, and acute inflammation are all examples of cellular responses unchecked by normally self regulating pathways. The absence of a single protein or lipid can result in the disruption of a pathway that may be crucial for cellular function. The CCS Faculty seeks to understand these fundamental signaling pathways. By identifying technologies to manipulate the signaling processes, highly selective pharmaceutical agents can be developed to treat cancer, diabetes, and cardiovascular disease.

- New technology from CCS has also been developed and licensed by Echelon to create a molecular sensor for directly monitoring heparin levels in blood.
- A microbiological assay platform invented by Dr. C. D. Poulter for identification of selective anti-anthrax agents was also optioned by Echelon.
- The discovery in 2002 of a natural ligand for the nuclear protein target of the $3 B/yr diabetes drug rosiglitazone emerged from collaboration by Dr's. McIntyre, Prestwich, and Zimmerman.

UU
Funded 1997-2002

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Spin Out Companies

- Echelon Biosciences, Inc.
- Salus Therapeutics - acquired by Genta Inc.

Benefiting Companies

- ComGenex
- Molecular Probes, Inc. - acquired by Invitrogen, Inc.

Center for CHEMICAL TECHNOLOGY

This center functioned as an innovative resource to the business community by conducting applied research in a variety of chemistry related areas leading directly to new or enhanced products.

The center facilitated the collaboration of Utah companies with diversified chemical interests to form alliances that benefited the company and the state.

- The Center has been awarded four patents
- License agreements with three companies
- Major contracts have been signed with TRW and AORC to study environmental fate of azide impacted landfills
- Corporate partner, Nutraceutical, Inc., has acquired two other companies and moved its manufacturing and marketing to Utah

Weber State
Funded 1990-1995

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Spin Out Companies

- Linco Technology (now First Scientific)
- ZymeQuest, Inc.

Benefiting Companies

- Nutraceutical
- Eastman Chemical

Center for CONTROLLED CHEMICAL DELIVERY

The Center for Controlled Chemical Delivery (CCCD) was established at the University of Utah in 1986, consisting of faculty from the Department of Pharmaceutics and Pharmaceutical Science. As an extension of these departments, the CCCD maintains a strong graduate training program and has attained a leading position in worldwide pharmaceutical, polymer, and biomedical research. Ongoing research projects at CCCD include:

- POLYMERIC MATERIALS
- NONTHROMBOGENIC SURFACES
- SELF-REGULATED INSULIN DELIVERY SYSTEMS
- TARGETABLE DRUG DELIVERY
- ORAL DELIVERY

UU
Funded 1988-1993

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Spin Out Companies

- Insutech/TTI

Benefiting Companies

- Research Medical, Inc.
- MacroMed
- TheraTech, Inc. - Watson Labs

Center for DAIRY FOODS TECHNOLOGY

The focus of the center is to develop new technologies to improve and develop products for the dairy foods industry.

The center uses membrane technologies (reverse osmosis and ultrafiltration) to concentrate fluid milk at low temperatures so as not to impart any off flavors to milk concentrates.

Another technology uses ultra-high temperature heat processing to commercially sterilize milk and milk concentrates yielding new products that do not require refrigeration and can be stored for up to 12 months. The concentrated and ultra high temperature process milk can be used in reconstituted fluid milk, yogurt, ice cream and cheeses.

- The center has an agreement with Utah Milk Technologies to commercialize membrane concentrated, sterile milk for export.
- A patent for the center's "Creamier Skim Milk" was issued in November 1994.
- Gossner Foods, Inc. Logan, holds the contract for the production and packaging of new products researched and developed by national food companies with the assistance of the center.
- Heart-to-Heart Foods, Inc., Richmond, which produces yogurt and ice cream products and new lines of cream cheese, has used center equipment and expertise to research and develop new product lines.
- International Dairy Foods Association has shown interest in "Creamier Skim Milk" to increase consumer acceptability of skim milk.

USU
Funded 1991-1996

Paul A. Savello
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Spin Out Companies

- Dairy Research Consulting of Utah
- Food Research & Dev Group
- Utah Milk Technology

Benefiting Companies

- Gossner Foods, Inc
- Nichols Research
- NutriScience, Inc
- R-Con International

Center for DAIRY TECHNOLOGY COMMERCIALIZATION	
The Center for Dairy Technology Commercialization was established to commercialize technologies developed at the Western Dairy Center, whose research is funded by a consortium of dairy food companies, for a variety of applications in the dairy industry. The Center is currently pursuing commercialization of the following inventions: utilization of bacterial cultures that produce polysaccharides externally to increase cheese yield; production of flavored cheese using high pressure injection technology, using textured whey protein both as a meat extender and as a high protein snack food.	*USU* *Funded 1998-2001* Carl Brotherson (435) 797-3466 wcdprt@cc.usu.edu **Benefiting Companies** • Shepherds Goat and Sheep Dairy Products, LLC - acquired by Fire Ridge Ranch LLC, Shepherds Dairy.
• Cheese trials have begun using the exopolysaccaride gene to determine commercial interest among cheese producers. • One company intends to modify the cheese flavor and the other company will use the technology as a method of creating new and novel cheeses for children.	

Center for DESIGN OF MOLECULAR FUNCTION (formerly BIOCATALYSIS)	
With funding of approximately $1.8 M from the NIH Biomedical Research Technology Program, the Center for Biocatalysis Science and Technology has expanded to become the National Center for the Design of Molecular Function. The goals are to: 1. Establish the underlying bases for the design of molecular function which includes the development of real-time time-resolved spectroscopic technology 2. Apply this basic knowledge and technology to biomedical and environmental applications and monitoring 3. Provide this information and specialized tools of its utilization to the scientific and engineering community	*USU* *Funded 1988-1994* Linda Powers (435) 797-2033 lsp@biocat.ece.usu.edu **Spin Out Companies** • Envirol • Whetstone • MicroBioSystems, LP **Benefiting Companies** • CSA of Provo, Utah
• Two patents have been issued, two are allowed, and several are pending • The capture surface identification technology selectively bind bacterial cells, spores, toxins, and viruses [many from the CDC select agent list] using molecular engineering methods. • DARPA is currently funding a team effort on self decontamination surfaces. • The optical reader technology was demonstrated for the detection of microbial contamination in public water supplies for the Department of Public Health of Utah, the EPA and the Office of Public Health of the State of Louisiana in the aftermath of hurricane Katrina.	

Center for DEVELOPMENTAL AND MOLECULAR BIOLOGY	
Technologies are being developed for the high efficiency production of valuable proteins, not normally found in animal milk, by producing transgenic animals. A specific gene (DNA sequence) that codes for a specific protein is placed under the genetic control of a promoter that is expressed in mammary cells during lactation. The "genetically engineered DNA" is introduced into the embryo of selected animal species which, when successful, express the desired protein in the milk producing cells. The expression of the foreign protein in the milk in relatively high quantities provides a cost-effective method of producing the valuable proteins.	*USU* *Funded 1992-1998*
	Kenneth White & John Morrey (435) 797-2194 kwhite@cc.usu.edu
• Genes for specific proteins have been sequenced and prepared for injection into animal embryos. • Transgenic nature of newborn animals confirmed • Expression of a valuable protein has been confirmed in these animals' milk	**Spin Out Companies** • Pangenics, Inc.

Center for ENVIRONMENTAL TECHNOLOGIES

Established to support Utah's environmental technologies industry through focused research and development in monitoring and sensing technologies, waste-stream reduction technologies, pollutant destruction and remediation, technology transfer, and advanced technical training. The center focused on the following:

- Knowledge-based expert system for Waste-fed Cement Kilns.
- Environmental applications of Time-of-Flight Mass Spectrometry
- Environmental applications of the Air-Sparged Hydrocyclone (radionuclide separations, oil-water separations, VOC stripping).
- HydroPur industrial wastewater recycling system.

- A subcontract was signed with Thiokol Corp. For development of an electrolytic process to recycle industrial wastestreams. A pilot plant is in place at Thiokol.
- The Center has formed strategic partnerships with twelve companies and federal installations.

USU
Funded 1992-1995

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Benefiting Companies

- Thiokol
- Dugway Proving Ground

Center for GENETIC IMPROVEMENT OF LIVESTOCK

Established to identify genetic markers for economically important traits of livestock. The first trait for which genetic markers were identified, was for callipyge gene in sheep, responsible for heavy muscling. Sheep carrying the callipyge gene have 8% more muscle, 8% less fat and 2% less bone, when compared to sheep that do not express the gene. The center also identified a genetic marker for Spider Lamb Syndrome (SLS), which results in severe bone deformities of the legs and back.

- The center determined that the callipyge gene provides an additional 10.3% to the value of each marketed sheep.
- Developed a test that is 97% accurate in identifying the callipyge gene and 100% accurate in identifying the SLS gene.

USU
Funded 1993-1997

Noelle Cockett
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Spin Out Companies

- Livestock Molecular Research and Development, Inc.

Center for GENOME TECHNOLOGIES

The Center's main focus was on developing and refining technologies for large scale sequencing and genotyping of DNA, the genetic material involved in inheritance of every organism. The Center was also developing technology for gridded DNA array detection.

The Center developed novel technologies in three areas:

- Molecular reagents and techniques
- Automated sequencing devices
- Computer software.

UU
Funded 1996-1998

Robert Weiss
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bobweiss@genetics.utah.edu

Spin Out Companies

- Cimarron Software Inc.

Center for HOMOGENEOUS DNA ANALYSIS

This new center was formed to commercialize a novel suite of fast, user-friendly and inexpensive DNA sequence analysis tools that could be fielded in a doctor's office rather than requiring the services of an expensive reference laboratory, and which will reach markets including cancer testing, the diagnosis of inherited diseases, and rapid bioterrorism detection.

The central innovation involves a new, high-resolution twist on a very old technique for DNA sequence analysis: thermal denaturation profiles. A fluorescent dye, added before amplification via polymerase chain reaction (PCR), allows the melting transition of the PCR product to be continuously monitored without ever moving it from the same tube. Data processing allows even minute sequence changes to be readily identified through their effect on the melting profile.

- The Center's first product has been licensed to a Utah firm, Idaho Technologies, Inc., which has commenced commercial sales.

UU
Funded 2003-

Carl Wittwer
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Benefiting Companies

- Idaho Technologies, Inc.

Center for IN SITU OZONATOR	
The powerful oxidizing power of ozone is harnessed in a safe, effective mechanism wherein sediments are processed and redeposited in a minimally invasive manner – immediately arresting contaminant release into the water, capping deeper contaminated layers, and promoting the onset of natural biodegradation.	*UU* *Funded 2003-2004*
• Center has already completed laboratory treatment tests on PCBs and DDT • International patent pending • Funding from both government and industry partners	P.K. Andy Hong (801) 581-7232 hong@civil.utah.edu

Center for LASER INSTITUTE	
The main focus is the development of cardiac surgical laser devices, drugs (photosensitizers), fluorescence sensors, laser fibers and laser power sources in the photodynamic therapy of cancer, and multiple wavelength treatment capabilities for Laser surgery. • Fiber optic lasers • Light activated drugs • Metal vapor laser applications • Laser angioplasty • Cardiac surgical laser devices • Fluorescence sensors	*UU* *Funded 1988-1989*
	Richard C. Straight
• Six patent applications	**Benefiting Companies** • Benefiting Co • HGM Corp.

Center for MEAT PROCESSING TECHNOLOGY

The center focused on the development of new meat products and processing technologies, including:

- Ultra-High Temperature (UHT) pasteurization of meat surfaces.
- Low-fat lamb chops, beef steaks, pork chops, and bacon.
- Processing technology to reduce fat content of raw meat.
- Processing technology to bond meat to bone.
- Combining UHT with electron beam radiation technology to produce sterile meat products.
- UHT pasteurization combined with High-Temperature Aging (HTA) to produce tender steaks and roasts from the cheaper, less tender primal cuts of beef carcasses.

- Four patents issued
- Two license agreements: B.V. Holland and Agri-Products Inc.

USU
Funded 1991-1996

Von T. Mendenhall, Ph.D.

Spin Out Companies

- Mountain Lamb Co-op
- Timpanagos Meats
- Canyon Rayas

Benefiting Companies

- B.V. Holland
- Agri-Products, Inc.
- ConAgra
- E.A. Miller & Sons
- NUTEK, Corp.
- Stone Meats

Center for MICROARRAY TECHNOLOGY

Developing a superior microarray platform for the molecular diagnostics and research markets with improved sensitivity, specificity and throughput.

- Six patent applications in process for molecular diagnostics technologies

UU
Funded 2005-

Steve Blair
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Spin Out Companies

- Sigma Technology Holding Company

Center for NEURAL INTERFACES	
It is only by recording the activity patterns of large groups of neurons that we can begin to understand how sight, hearing, touch and volitional information are encoded and processed by the brain. The center for Neural Interface has created a tool that makes this investigation possible. The center is focused on the development of technologies that will permit bi-directional (i.e. stimulation and recording) communication with large numbers of neurons in the central and peripheral nervous systems. The center has developed silicon-based arrays of microelectrodes that can either listen in on or talk directly to hundreds of neurons simultaneously. The center has also developed the surgical tools and techniques that allow these high-density arrays to be implanted in central and/or peripheral nervous systems. The long range goal is to use these neural interfaces as therapies for disorders of the nervous system e.g. limited, but functional sensory restoration in individuals with blindness or deafness, and enhanced motor function to individuals with high spinal cord injuries.	*UU* *Funded 1995-2000* Richard A. Normann, Ph.D. (801) 581-8528 normann@cc.utah.edu **Spin Out Companies** • Bionic Technologies **Benefiting Companies** • Cyberkinetics

Center for NUCLEAR, MEDICAL & ENVIRONMENTAL TECHNOLOGIES	
The commercial strategy of the Center for Nuclear, Medical, and Environmental Technology (CNMET) is to acquire selected spin off facilities and consolidate existing niche markets into a single, well-managed and licensed entity that can provide a convenient source for a full range of nuclear services. Large companies are currently downsizing, outsourcing, and eliminating risky and costly nuclear research and development (R&D) capabilities, and are teaming with universities with established nuclear engineering programs and research facilities to perform key services. An additional market trend is for companies to off-load ownership and operation of their nuclear testing, diagnostic, and irradiation facilities, and to contract with new owners for specific access and services. Others are simply decommissioning their nuclear facilities without replacement. The result is a decrease in availability of licensed facilities. That, in combination with an increasing demand for services from the private sector, provides the basis for a solid commercial opportunity. E-Cubed and Nuclear Labyrinth will assume commercial production to reduce costs, implement uninterrupted production cycles, and achieve economies of scale. Appropriate R&D functions then will be merged and contracted to universities with nuclear facilities, such as the University of Utah's TRIGA reactor, to promote innovation, train co-operatively, and supply a steady stream of knowledgeable and seasoned potential employees to the workforce.	*UU* *Funded 2001-2003* David M. Slaughter (801) 585-0759 slaughter@nuclear.utah.edu
• Nuclear Labyrinth is a newly formed company under CNMET that will engage in commercial nuclear services beginning in 2006.	**Spin Out Companies** • Nuclear Labyrinth

Center for RAPID MICROBE DETECTION

The focus of this center is the development of technologies which lead to the real-time detection of pathogenic micro-organisms. This involves the development of novel pathogen capture molecules, platform development, prototype development, and commercialization. Industries where this technology is useful include pharmaceuticals, biomedicine, biotechnology, veterinary, production agriculture, food processing, public health, defense, and water and sewage treatment. To date, four technologies have been developed:

- ImmunoFlow
- ImmunoDNA
- GlycoBind
- TissueTag

- The Center has licensed the ImmunoFlow technology to Stellar Technologies.
- 5 international patents issued, several more pending
- Seeking commercialization partners

USU
Funded 1998-2003

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Marie Walsh
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Spin Out Companies

- Bio Matrix Solutions
- Finite Technologies

Benefiting Companies

- Stellar Technologies

Center for SIGNAL PROCESSING

BYU
Funded 1988-1990

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Rarely is a technology developed that is still valid 15+ years after it was first introduced. The Center for Digital Signal Processing was the first to create a way to accurately simulate digital imaging and digital sound.

The technology is comprised of three elements. Digital signal processing is the first. It has been marketed primarily to the military for use in creating accurate simulations for pilot training or military treasure hunts.

Digital signal hearing is the second. It has been used to create a better hearing aid.

The third, multi-spectral imaging is the technology being used to read ancient damaged scrolls. Script reading is just one of the applications for multi-spectral imaging.

Spin Out Companies

- Deseret Digital Design
- Sonic Innovations
- Vector Technology
- ASTECH

Benefiting Companies

- Eyring Research Institute
- Softsolutions
- Space Dynamics Laboratory
- Unisys Corp.

Center for THERAPEUTIC BIOMATERIALS

UU
Funded 2004-

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The Center for Therapeutic Biomaterials (CTB) prepares and uses new biomaterials for reparative medicine for the 3-D culture of human cells. The Center Develops applications of biopolymers and hydrogels for clinical use in wound repair, prevention of surgical adhesions, and extending the life of donated organs as well as permitting evaluation of cell response to various compounds. The compounds also have application in a variety of non-medical applications, such as cosmetics.

Spin Out Companies

- Sentrx Surgical
- Sentrx Animal Care
- Glycosan Biosystems

Center for VALUE ADDED SEED TECHNOLOGY	
The center was established to produce value-added crops: • Drought resistant turf grasses for roadways, lawns, golf courses (require 30-40% less water • Forage grasses with superior yield under arid land conditions • Hybrid vigor in wheat using molecular biology.	*USU* *Funded 1991-1997*
	H. Grant Vest grant@usu.edu
• A new forage grass, crested wheatgrass variety CD-2, has been released and licensed to 6 companies. • The DNA based genetic markers for apomixis (asexual seed formation) genes are being used to tag apomictic Australian wheat grasses. • Proprietary tissue culture media and procedures are being refined and show promise for use in the mass cloning and genetic engineering of agronomic, horticultural, and forestry plants.	**Spin Out Companies** • F1 Technologies

Center for VASCULAR BIOTHERAPEUTICS	
The Center for Vascular Biotherapeutics is focused on commercializing medical strategies and devices that target blood vessel formation for the treatment of cancer and obstructive vascular diseases such as atherosclerosis. This Center capitalizes on a robust scientific program aimed at deciphering the molecular blueprint for vessel regeneration using human genetics and transgenic mice technologies; these technologies were pioneered at the University of Utah. The "Functional Vascular Genetics" program established at the University of Utah is identifying genes that are essential for vascular development.	*UU* *Funded 2001-*
	Dean Y. Li (801) 585-5505 dean.li@hmbg.utah.edu
• Negotiations for a licensee are in progress and we have designed and tested a first generation elastin sheath-stent and showed it to be effective in preventing restenosis in a porcine model.	**Spin Out Companies** • Hydra Biosciences

Center for VENTRICULAR ASSIST DEVICE	
The goals of the center are to develop a magnetically suspended centrifugal blood pump to be used as continuous-flow ventricular assist device for nearly all sizes of human patients. A prototype continuous flow ventricular assist device (CVAD2), which has all-electromagnetic bearings has been designed and developed. The centrifugal blood pump is gentle to the blood and is suspended in magnetic bearings. The pump output (rotor speed) is readily controlled to meet the physiologic needs of the patient. This device can pump blood over a wide range of cardiac output from 1 to 10 liters/min, effectively satisfying the physiological needs and excellent blood flow dynamics.	*UU* *Funded 1995-1996*
	Donald Olsen, Ph.D. (801) 581-6991 don.b.olsen@m.cc.utah.edu
• The center received the Sezai Innovative Research Award at the International Society for Rotary Blood Pumps in 1995.	**Benefiting Companies** • MedQuest

Center for X-RAY IMAGING	
This center has successfully commercialized x-ray research by carving a product niche among the biggest manufacturers in the analytic instrument business. The ability to reflect and focus x-rays permit scientists to achieve remarkably high resolution when measuring minute objects. Experiments should begin soon on the compact x-ray laser, an instrument necessary for the success of the Strategic Defense Initiative. In addition to defense applications, advanced x-ray technology is used to detect trace materials in substances and would provide simpler, safer medical testing. Applications include: • Atomic Layer Epitaxy (ALE) • MultiLayer X-ray Optics • Leading edge technology in X-ray imaging • X-ray laser technology • Thin film technology and diagnostics • Bright x-ray sources • Electronic x-ray detectors • Damage resistant nano structures • Pure silicon production	*BYU* *Funded 1988-1992*
	Larry Knight larry_knight@byu.edu
	Spin Out Companies • MOXTEK **Benefiting Companies** • TechniScan

Software Development and IT Cluster

Center for 3D COMPUTER GRAPHICS / 3D SOFTWARE	
In the early stages of computer graphics technology, a software library of three dimensional shapes and textures in a computer environment was created by the Center for 3-D Computer Graphics. Though this does not seem "amazing" in today's world, at the time it was cutting edge technology. The center studied the practical applications of three dimensional modeling for the graphic arts industry. It created one of the first web pages in Utah.	*Dixie State College* *Funded 1991-1996* Eric Pederson (435) 652-7977 pedersen@dixie.edu **Spin Out Companies** • Illustrative Impressions • Infowest • NetEx • Paintbrush Productions • AK International **Benefiting Companies** • Mira Imaging • Strata, Inc.

Center for ACCOUSTICS RESEARCH	
Commercializing active sound control technology with superior ability to both reduce noise in varied settings (vehicle cabins, computer fans and telecommunications, e.g.) and modify sounds for commercial benefit.	*BYU* *Funded 2005-* Scott Sommerfeldt (801) 422-2205 scott_sommerfeldt@byu.edu

Center for ADVANCED COMMUNICATIONS TECHNOLOGY	
The Center for Advanced Communications Technology was formed to commercialize multi-antenna wireless communications: the main focus is using multiple antennas for robust wireless links to maneuvering air vehicles (tactical aircraft and UAV's). A secondary focus is in applying multi-antenna technology to improvement of commercial wireless communications. The Center has forged strong links with industry and with government as they've developed and refined the technology.	*BYU* *Funded 2004-* Michael Jensen (801) 422-5736 jensen@ee.byu.edu

Center for ASYNCHRONOUS CIRCUITS	
The Center for Asynchronous Circuit and Systems Design was established in 1997 to complete the development of software design tool that will allow engineers to efficiently design digital circuits that do not require a global clock in order to operate. While most of today's digital systems use a synchronous global clock to coordinate operations within an integrated circuit, the challenge of distributing such global clock signals becomes increasingly difficult as circuit densities increase. Asynchronous circuits do not require a global clock and therefore do not require clock distribution lines as traditional synchronous circuits do. Industry has not moved to asynchronous design in large part owing to a lack of computer aided design (CAD) tools supporting this technology. Meeting this need is the direct target of this Center. This Center is working with companies such as Intel and IBM not only to help solve their future asynchronous design problems, but also their current difficulties in the analysis and verification of high-speed integrated circuits.	*UU* *Funded 1997-2000* Chris Myers (801) 581-6490 myers@ee.utah.edu
• Significant design verification work was completed at IBM's Austin Research Laboratory, which has resulted in a non-exclusive license agreement with IBM to evaluate the Center's analysis tool in IBM's design flow. • The center worked in collaboration with Sonic Innovations, a spin-out of another Center, designing digital hearing aids. The Center is designing an asynchronous version of their hearing aid that will significantly reduce circuit size and power consumption.	

Center for BASE EDUCATION TECHNOLOGIES	
The center focused on creating new base education technologies.	*UU* *Funded 1987-1988* Carol Weller
• Two companies were formed out of this center, one focused on assessments, the other on developing software	**Spin Out Companies** • Assessment Co. • Software Co.

Center for COMMUNICATIONS RESEARCH	
The Center focused on the following technologies: • Multiple access communications • Coded modulation systems • High performance medical imaging • Vector quantization • Adaptive digital filters • Neural networks	*UU* *Funded 1987-1990* Craig Rushforth ckrush1@msn.com **Spin Out Companies** • Techniscan
• 2 patents granted on decoding algorithms • Unisys using products for expansion of Utah operations • Spin-out Techniscan awarded Phase II SBIR for $500K	**Benefiting Companies** • Unisys

Center for COMPUTER BASED EDUCATION	
Established as a center in 1987. State-of-the-art computer-based systems have been designed to improve foreign language and computer science instruction. These programs, currently being adopted by industry and education, are training those from kindergarten through adult education. Improved tools for the design, development and delivery of computer instruction systems are revolutionizing teaching and learning methodology.	*BYU* *Funded 1987-1991* Jerry Larson (801) 422-6529 jerry_larson@byu.edu **Spin Out Companies** • Cali, Inc. - Now Ellis **Benefiting Companies** • LinguaTech

Center for COMPUTER GRAPHICS AND SCIENTIFIC VISUALIZATION	
Established in 1991 to develop integrated computer aided solutions to problems in computer graphics, scientific visualization, computer aided geometric design and computer-aided manufacturing for industrial applications. Computer design, modeling, graphics, and manufacturing technology for automating the whole "art-to-part" process, scalable from a small job shop to a large advanced industrial shop, national televideo infrastruction and learning via the national information highway.	*UU* *Funded 1990-1996* Risenfeld and Cohen, Ph.D.'s (801) 581-8235 cohen@cs.utah.edu **Spin Out Companies** • Engineering Geometry Systems
• Spin-out Engineering Geometry Systems (EGS) • EGS has created and delivered a custom product to Hill Air Force Base to increase its manufacturing productivity	

Center for COMPUTER INTEGRATED MANUFACTURING	
The focus of the center is on the development and application of software, hardware and courseware, required for manufacturing systems integration; including software for variant and generative process planning, knowledge based systems, electronic component selection and a shop-floor data collection system.	*BYU* *Funded 1987-1989* Dr. Dell K. Allen **Spin Out Companies**
• IBM donated money to assist with research applications	• CIM Training Center • EDGE Foundation • EDGE Inc. • Ozone Saver Industries • Smartware • Utah PODS Manufacturing Co-op • CAM Software

Center for COMPUTER NETWORKS	
The main focus of the Center was to develop computer assisted methods for the design analysis, and simulation of large computer information networks. • Computer assisted methods for design analysis • Research for local area & large computer networks including network optimization software, network traffic models and verification software	*USU* *Funded 1987-1989*
	Dr. Bruce R. Peterson
• Assisted in creating ICOMP • Strong relationship with Novell	**Benefiting Companies** • ICOMP • Novell

Center for DESIGN SYSTEMS	
The Center focuses on researching, designing, developing and commercializing software that brokers information in a time critical way for manufacturing, distribution and design companies.	*UU* *Funded 1995-1996*
	Don R. Brown, Ph.D. dbrown@part.net
• Provision patent application in August 2006	**Spin Out Companies** • ErgoWeb • PartNet

Center for ELECTRONIC MEDICAL EDUCATION	
The objective of the Center for Electronic Medical Education was to develop software technology for use by physicians and scientists who require images as the primary means of communication and consultation. Initially the software consisted of tools to help medical professionals make diagnoses in real time using a database of images as a reference. The center extended development into three markets: 1) consultation, 2) medical and scientific imaging and 3) telehealth. The goal was to improve the process of delivering healthcare and scientific discoveries for the purposes of consistent communication and collaboration and by linking visual annotations and clinical notes to images without altering the images. By maintaining a consultation record, two physicians could have a consultation about the same patient in geographically distant locations. Both physicians could review clinical information (images and text) at the same time, discuss aspects of the clinical review and maintain an auditable record of the consultation.	*UU* *Funded 1999-2004* H. Ric Harnsberger, MD (801) 231-0637 Rharnsberger@amirsys.com **Spin Out Companies** • Amirsys • VisualShare • Globalmatics

Center for ELECTRONIC SYSTEMS TECHNOLOGY	
The Center for Electronic Systems and Technology combined the expertise, resources, and capability of three universities--the University of Utah, BYU, and Utah State University--to serve the industrial community in electronic systems technology. The goal of the Center is to ensure that Utah industry can compete more effectively in the global market and to enhance the opportunities for Utah researchers to develop and commercialize their technologies Electronic systems technologies include microelectronics, digital electronics, RF, microwave, millimeter wave electronics, as well as optoelectronics. The Center provides research, design, evaluation, and prototyping services to Utah businesses that need specialized help in developing new products or enhancing market strengths. Services provided to industry include access to test equipment, laboratory testing, fundamental research and technology development, market analysis, personnel, information, and strategic planning.	*UU* *Funded 1995-1999* R. Jennifer Hwu, Ph.D. and Benjamin V. Cox, Ph.D.
• Research contracts with a large number of technology-based companies were executed • The Center also provided a stream of new commercializable technologies that were patented and offered for licensing to Utah companies	**Spin Out Companies** • Bonneville Technologies • HDG

Center for GLOBAL KNOWLEDGE MANAGEMENT	
This Center was formed to effect the commercialization of software tools representing the next generation of data mining technology, with the potential to leapfrog competing approaches by enabling customers to both quickly and inexpensively discover useful knowledge from databases and efficiently manage that knowledge over time as the underlying data or conditions of use change.	*UU* *Funded 2003-2006*
• New Software Acculink in validation process	Olivia Sheng (801)-585-9071 olivia.sheng@business.utah.edu

Center for HIGH SPEED INFORMATION PROCESSING

USU
Funded 2002-2005

Tamal Bose
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The Center for High Speed Information Processing, focuses on miniaturizing digital devices by using faster algorithms (multiplier free technology), which allows the manufacturing of smaller, faster and cheaper chips.

Echo cancellation technology is the first application. It eliminates the echo that is created on a speaker phone or cell phone when two people talk at the same time. Two patents for this technology have been issued. This same technology can also make it possible for a person with hearing aids to hear someone (s)he is talking to when there is background noise. For hearing impaired people, this is revolutionary. With current hearing aids, when there is background noise, voices are canceled out, producing empty static.

Another area is building encoders and decoders for error correction that are compliant with emerging standards for low density parity check codes. This technology is in a commercialization phase.

- First spin out company, SP Communications was formed.
- Smaller, faster, cheaper chips are being developed by this center.
- A large Utah based company currently has licensing with the University for the technology connected to hearing-aid feedback

Spin Out Companies

- SP Communications

Center for INDUSTRIAL IMAGING

UU
Funded 1995-1999

Robert Ehrlich, Ph.D.
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The Center was established to commercialize image analysis, data analysis, and artificial intelligence technologies developed in the geosciences. Research at the University on fluid flow through porous media (i.e., aquifers, petroleum reservoirs) has resulted in generally useful image processing, image analysis, data analysis, and artificial intelligence techniques with commercial applications in geosciences and engineering.

Center technologies include Petrographic Image Analysis (PIA), which comprises four components: image acquisition, image processing, pattern recognition/data analysis, and linking to physical models. Each component involves specialized hardware, software, and expertise. The pattern recognition procedure within PIA has also proven useful in chemical fingerprinting in a variety of geoscience/environmental applications. The Center has begun to explore areas outside geoscience applications, including the application of PIA to medical imaging, and especially to automated screening of prostate biopsies. The Center also has been granted ownership of Integrated Paleontological System (IPS) software for further research, development, and commercialization. The Technical Alliance for Computational Stratigraphy (TACS), a consortium of nine petroleum companies, has been established to fund a three year commercialization and development initiative.

- GeoChem Metrix, Inc. was spun-off in September 1998. The company specializes in analysis of chemical data in the context of environmental and toxic tort litigation support.
- Two new software license agreements were signed with BP-Amoco Upstream Technology and Elf Exploration Production for the TACS consortium.

Spin Out Companies

- GeoChem Metrix, Inc.

Benefiting Companies

- BP-Amoco Upstream Technology
- Elf Exploration Production

Center for INFORMATION TECHNOLOGY - HANDICAPPED EDUCATION	
The Center for Information Technology—Handicapped Education was funded with two purposes in mind: first, to meet a federal requirement that government and education offices provide closed captioning for training videos, and second, to promote information technology in public schools. K-SAR captioning software was developed, as well as reading and other software for educators.	*USU* *Funded 1989-1991* Alan Hofmeister hofa@cc.usu.edu **Spin Out Companies** • Effective Instructional Tech

Center for INTELLIGENT COMPUTER TOOLS	
The Center focuses on interactive image segmentation, composition and digital image editing, automated creation/browsing of digital (microfilm) libraries, semiautomated creation of virtual environments, especially with Virtual Venues for the 2002 Winter Olympics. • The Center teamed up with a CA company to produce media for the 2002 Olympics which was featured on big screens along with individual event media.	*BYU* *Funded 1996-2001* William A. Barrett (801) 378-7430 barrett@cs.byu.edu **Benefiting Companies** • Virtual Venues • Adobe Systems • Park City Entertainment.

Center for INTERACTIVE RAY TRACING & PHOTOREALISTIC VISUALIZATION	
Producing a commercial form of two programs that can process 3-D graphics based on large data sets found in CAD, film animation and scientific models, which existing GPUs cannot handle	*UU* *Funded 2005-* Steven Parker (801) 585-1504 sparker@cs.utah.edu

Center for INVERSE PROBLEMS, IMAGING & TOMOGRAPHY

The Center for Inverse Problem, Imaging and Tomography (CIPIT) is the result of research efforts conducted at the University of Utah's Advanced Imaging Methods Laboratory (AIM lab). The AIM lab was developed to study medical ultrasound imaging. Further research was then introduced in advanced sonar and geographical/environmental imaging methods based on common mathematics. In 1990, the AIM lab submitted a proposal for independent support as the CIPIT and initial funding was received in February of 1991. Some of CIPIT's technical accomplishments are in the areas of:

- MEDICAL ULTRASOUND
- HAZARDOUS SITE IMAGING
- 3-D MICROSCOPE

UU
Funded 1989-1993

Steven A. Johnson
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Spin Out Companies

- Monolithic Tech
- Techniscan Medical Systems

Center for MAGNETISM IN INFORMATION TECHNOLOGY

The center was established in 1995 to produce superior magnetic materials including permanent magnets and magneto-resistive materials, which
would have applications in numerous markets including products such as motors, sensors, magnetic storage media, and electromagnetic circuitry.

- An agreement has been signed between the center and a Utah company, for the company to manufacture high corrosion resistance rare-earth materials using center technology.
- The center is collaborating with the Idaho National Engineering Laboratory (MEL) to develop efficient processing for permanent magnetic materials.
- The center is also working with a Utah company to manufacture flexible magnetic materials.
- The center is working with a Utah company to develop a new type of sensor for applications in the automotive industry.

USU
Funded 1995-1996

C.Y. Pan

Benefiting Companies

- Starsys

Center for MTV FLAT PANEL DISPLAY TECHNOLOGY	
Established in 1995 to study new technologies in producing flat panel displays for the information (e.g. computer monitors) and entertainment (e.g. television sets) markets. The main focus is to conduct proof-of-principle research on new and emerging potential flat panel display technologies and to evaluate new and existing flat panel display technologies. An additional focus is to create and support applications needed by flat panel display manufacturers especially those located in the State of Utah.	*UU* *Funded 1995-1997*
• Developed a new, enhanced flat panel display for which a patent application has been submitted. • Established a close working relationship with a local company involved in flat panel display development. A new company has been established with an option to license the flat panel display technology. • Received Department of Energy funding to investigate another spin-off technology for micro-energy converters under a collaborative development effort with Sandia National Laboratories.	Laurence P. Sadwick sadwick@ee.utah.edu

Center for MULTI-DIMENSIONAL INFORMATION - CROMDI

The Center for Multi Dimensional Information—CROMDI was established to commercialize audio-visualization technology that facilitates the rapid and accurate analysis of large quantities of quickly changing data. By visually displaying multiple variables using various objects and colors, a wide range of information is clearly presented. IntuInfo, the patented technology, enables the processing of events significantly faster and more accurately, while requiring less training from those who use the software. The areas of application are broad: finance programs, homeland security systems, DOE contacts, medicine, and entertainment. The most successful application at this time is in finance and networking.

- Licensing agreements with several existing companies have been negotiated.
- This center can quickly process large amounts of data and generate easy-to-interpret results.

UU
Funded 2000-2004

Stefano Foresti
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Spin Out Companies

- Applied Medical Visualization, Inc

Benefiting Companies

- GE Medical Systems
- Draeger Medical

Center for MULTIMEDIA EDUCATION AND TECHNOLOGY

Established in 1993 to develop state-of-the-art, interactive multimedia technology and also to author and produce with industrial partners a wide range of commercial training and education applications.

Interactive multimedia computer-based authoring systems. Some authoring technologies will be copyrighted, held, and owned by WSC and the Center while others will be developed with external corporate partners.

UVSC
Funded 1992-1995

Gary L. Phelps

Spin Out Companies

- Cela Solutions Inc.
- MC2
- Memory Lane Productions
- Utah Valley On-Line

Center for MULTIMEDIA EDUCATION AND TECHNOLOGY	
Established in 1993 for the development of interactive multimedia software modules for science, mathematics, and engineering education. Software and hardware interactive multimedia products for education including simulation software, virtual laboratories, software and hardware for data acquisition and analysis, inexpensive virtual reality applications. Production and distribution of interactive multimedia educational modules on CD-ROM.	*UU* *Funded 1993-1997*
• Two CD-ROM products have been developed: a multiplatform "Calculus Castle and "Engineering Electromagnetics." Another CD-ROM in genetics, "History of the Human Gene," is also completed. The Center is actively pursuing commercialization of these products. • The center manages the Conceptual Learning of Science (CoLoS), USA project, which is a consortium of eleven universities and is sponsored by Hewlett-Packard Company. • In collaboration with John Wiley & Sons, the center continues to publish the award-winning journal, "Computer Applications in Engineering Education." • The center hosted an international conference "1996 Frontiers in Education" in Salt Lake, which had 617 attendees from 14 countries.	Richard W. Grow (801) 581-7634

Center for ORGANIC ELECTRONICS	
Development of new polymers for the creation of OLEDs (Organic Light Emitting Diodes) resulting in the commercialization of organic semiconductors with superior luminescence efficiency and color spread, for multicolor displays and white light illumination.	*UU* *Funded 2006-*
	Valy Vardeny (801) 581-8372 val@physics.utah.edu

Center for PARALLEL SUPERCOMPUTING	
The Center was focused on Phase I Beta Testing including training, software porting, performance and development. There was potential for the center to become unique nationally in comparing supercomputer architectures.	*UU* *Funded 1988-1989*
• IBM provided a 3090 ($11.7MM) • Convex donated upgrading components for a C-120 and a C-220 to supercomputer status with a $100K donation • CSA donated a 16 processor system systolic processor for supercomputer at smaller workstations	Dr. Douglas Chabries

Center for SCIENTIFIC COMPUTING AND IMAGING	
The Center for Scientific Computing Imaging, SCI, developed the SCIRun technology, which provides scientists and engineers with a new model for scientific computing. The model uses graphic interfaces and 3D graphics to provide a visual program for solving complex problems. Previously three separate programs had to be used. SCIRun incorporated the programs into one	*UU* *Funded 1996-2000*
	Chris Johnson (801) 581-7705 crj@cs.utah.edu
• The SCI Center has become the SCI Institute, which has a huge impact on Utah's economy.	**Spin Out Companies** • Visual Influence, Inc.

Center for SOFTWARE SCIENCE

The Center for Software Science created a complete integration capability to enable a Unix based program to be run in a Windows Operating System. The product allowed for compatibility between PC and Unix workstations throughout the country, running approximately 150 functions.

This was an especially useful software during the transition from Unix to a Windows based environment. At that time the center was well funded. However once Windows became the standard, the need for this technology almost completely disappeared.

- This technology was critical during the transition from Unix to Windows Operating Systems.
- While funded this center had a 17 to 1 match in funding.
- The technology enabled Unix based programs to be run in Windows Operating Systems.

UU
Funded 1989-1994

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Spin Out Companies

- Hippo Software

Center for SUPERCOMPUTING

The mission of the Center was to establish a High Performance Computing Center to serve as a computational resource for Utah companies and universities. This partnership among industry and education was a unique resource for solving scientific and engineering problems that required unusually large memory and visualization requirements.

The Center for Parallel Supercomputing, now the Center for High Performance Computing provides large scale computer sources to facilitate advances in the field of computational science.

The projects supported by CHPC come from a wide array of disciplines requiring large capacity computing resources, both for calculating the solutions of large-scale, two and three dimensional problems and for graphical visualization of the results.

The published results of research supported by CHPC facilities are maintained in the CHPC Bibliography (PDF).

- IBM contracted for $13M in matching funds
- Signed a new 3 year agreement with IBM regarding visualization

UU
Funded 1988-1992

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Benefiting Companies

- 3M Health Systems
- Eden Solutions
- Hercules
- IBM
- Kennecott
- Relational Technology Products
- SyncSort
- Thiokol
- WordPerfect

Center for VLSI DESIGN

The Center was established to explore a new technology called Path Programmable Logic (PPL), an innovative design approach for compact integrated circuits. This technology has been developed in response to an identified market niche for a less expensive, more user-friendly design program. The ability to interface PPL with other commercial software packages makes this design program attractive to smaller engineering firms needing custom integrated circuits.

- Joint venture was formed with a European company to sell center products in Europe

UU
Funded 1990-1992

Kent F. Smith
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Spin Out Companies

- Bonneville Microelectronics

Benefiting Companies

- Cirque Corp.
- IOMEGA Co.
- Phoenix
- Softeze

Appendix B – Benefiting Companies (by center)

CENTER	COMPANY
3D Computer Graphics	Mira Imaging
	Strata, Inc
ACERC	Ford, Bacon, Davis
	Geneva Steel
	Hercules
	IOMED
	Pacific Corp.
	Questar
	Sarcos Research Corp
	Sarcos, Inc
	Thiokol
	UP&L
Advanced Composites	AeroTrans
	American Polymer
	Ashton Aerospace
	Automated Process Control
	B&M Enterprises
	Beckwith Technology Group
	Bemsco
	BGA
	Blue Cow, Inc.
	Bradley Instruments
	ClayTech
	Controlled Composite Technology
	CRP/Springlite
	Curecrete
	DAH, Inc.
	Delta Fiberglass
	Dimensional Research
	DMS
	DPE
	EDO
	Evolution Skis
	Fiber Tek
	Futura Propulsion Systems
	H K Corporation
	Haelan Medical
	Hexatron
	Ideas to Products
	INCO VaporFab
	International Biokenetics
	LCC Fabrications
	Legends Technologies
	MATCO
	Medilight
	Mountain High Engineering
	Mountain Land Support
	Performance Composites
	Potter Management
	Pro Design Corporation
	Red Hawk, Inc.
	Rotomolding of Utah

Advanced Composites	Sound Composites
	Terra Tek
	TRA
	Ultralite of America
	UP International
	Utah Rocketry
	Van Patten Corporation
	Wasatch Engineering
	Wasatch Technology Group
Advanced Imaging LADAR	RapidMapper
Advanced Materials & Microelectronics	Bonneville Microelectronics
	Ceramatec
	Concoyle Oilfield Tools, Inc
	Evans & Sutherland
	Fisher Company
	Hercules
	Nova Tech
	Space Systems Engineering
	Thiokol
	Westcot Co.
Aerospace Technology	Intraspace Inc.
	R & D Inc.
	Wasatch Research & Engineering
Biocatalysis	Computer Systems Architects
	Hyclone Labs
Biopolymers	Becton Dickinson Critical Care Monitoring
	Cardiopulmonics, Inc
	Hyclone Labs
	Research Industries
	Silicon Graphics
Bioremediation	Non-invasive Geotracking
Biotechnology	AgriDyne Technologies
	EarthFax
	Thiokol
	UP&L
CAEDM	AgriDyne Technologies
	Albion Technologies
	Arrow Dynamics
	Artistic Precision Enterprises
	Bel Viso Labs
	Buena Ventura
	Bureau of Mines
	C.T. Film Inc.
	Cache Valley Cheese
	Chromalox
	Del Med, Inc
	Evans & Sutherland
	Great Basin Brine Shrimp
	Great Salt Lake Mineral
	Hercules
	Hewlett-Packard
	Hill AFB
	Industrial Research
	IOMEGA Co.
	KEMGAS
	Miller Labs

CAEDM	Monarch Labs
	Morton Automotive
	Reily Wendover
	Schreiber Foods, Inc
	Solaray
	Susumu Construction
	Thiokol
	Trysan
	VALTEK
	Viewpoint Animation
	Western Zirconium
	Williams International
Chemical Reactors	EIMCO
	Kennecott
Chemical Separations	ASARCO
	Cascade Refining
	DataChem
	GalTech Semiconductor
	Johnson Matthey
	Parish Chemical
	Tronac, Inc.
Coal Research	Advanced Processing Technology
	ATL (Springville)
	Flowserve (Springville)
Compliant Mechanisms	Grandway USA (Salt Lake City)
	ICON (Logan)
	MityLite (Orem)
	Recreation Systems (Kaysville)
Computer Based Education	LinguaTech
	MacroMed
Controlled Chemical Delivery	Research Medical Inc
	TheraTech Inc. (Watson Labs)
	Gossner Foods, Inc
Dairy Foods Technology	Nichols Research
	NutriScience, Inc
	R-Con International
Design of Molecular Function	CSA
Engineering Design	Sarcos Research Corp
Homogeneous DNA Analysis	Idaho Technologies
	Digitran
Information Technology (Handicapped)	SkiHi
	Systems Inpact Inc.
	Alta Technologies
	Computer Systems Architects
Inverse Imaging & Tomography	Evans & Sutherland
	MOXTEK
	TechniScan
	Unisys Defense Systems
	HGM Corp.
	Innovative Imaging Services
Laser Institute	MetaLaser Corp.
	Primemed
	QLT, Inc.
	ConAgra
Meat Processing Technology	E.A. Miller & Sons
	NUTEK Corp.
	Stone Meats

Novel TiB Surface Hardening	Ortho Development Corporation, Draper, UT
Pyrometallurgical	Kennecott
Quality and Integrity Design	Technology Mgt. Associates, Inc.
Rapid Microbe Detection	Stellar Technologies
Rapid Product Realization	Accuserve
	American International
	Bolick Co.
	CellTek, International
	GWH
	Hatch Biomedical
	Tile Roof Associates
	Youth Reclamation Inc.
Signal Processing	Eyring Research Institute
	Softsolutions
	Space Dynamics Laboratory
	Unisys Corp.
Space Engineering	Hercules
	Thiokol
Supercomputer	3M Health Systems
	Eden Solutions
	Hercules
	IBM
	Kennecott
	Relational Technology Products
	SyncSort
	Thiokol
	WordPerfect
VLSI Design	Cirque Corp.
	IOMEGA Co.
	Phonix
	Softeze
X-RAY Imaging	TechniScan
Supercritical Fluid	Process Engineering Resources
Solid Oxide Fuel Cells	Dionex
Profitable Uses of Agricultural Byproducts	FuelCell Energy (FCE) of Danbury, CT
	Agrimass – Cali – licensing
	Inrepid – ITR Idaho
Green Hill Recycling	Advanced Construction Materials
Soil Stabilization Inc.	Advanced Construction Materials
uniAMS	Advanced Construction Materials
Advanced Composites	ACI Technology
	Behavioral Technology Inc.
	Ridgeway & Fautz
	Springlite
Advanced Materials & Microelectronics	Beta Power Inc.
	Edo Western
Advanced Structural Composites	Patterned Fiber Composites, Inc.
Biotechnology	Natural Product Sciences
Composites in Construction	EDO Fiber Science
	Hydrotech
	Monroc, Inc. (Eagle Precast Co.)
	Sika
	Thiokol
	Waterpoint
Engineering Design	Animate Systems
	MicroJect, Inc.

Harsh Environment Electronics (formerly MTV Flat Panel)	Innosys
Profitable Uses of Agricultural Byproducts	HHE
Rapid Product Realization	UniFoods
Scientific Computing & Imaging	Manufacturing Extension Partnership
Self Organizing Intelligent Systems	Visual Influence Inc.
Solid Oxide Fuel Cells	Kuchera Defense Systems
	Fuel Cell Energy
	Versa Power Systems